SOIL SURVEY OF

Tucumcari Area, New Mexico

Northern Quay County

United States Department of Agriculture
Soil Conservation Service
In cooperation with
New Mexico Agricultural Experiment Station

Issued November 1974

Major fieldwork for this soil survey was done in the period 1961–67. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1967. This survey was made cooperatively by the Soil Conservation Service and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Canadian River Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the Tucumcari Area, New Mexico, Northern Quay County, are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit, range site, and wildlife habitat group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites. They can also refer to the section "Use of the Soils for Woodland and Windbreaks" where the soils of the county are grouped according to their suitability for windbreaks.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, streets and parking lots, excavations, landscapes, and recreation areas in the section "Use of the Soils for Community and Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Tucumcari Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the Area given at the beginning of the publication and in the section "General Nature of the Area."

Cover: **Montoya clay loam is in the foreground and Rough broken and stony land, steep, is in the background.**

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SOIL SURVEY OF TUCUMCARI AREA, NEW MEXICO, NORTHERN QUAY COUNTY

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE NEW MEXICO AGRICULTURAL EXPERIMENT STATION

THE TUCUMCARI AREA is in the northern three-fourths of Quay County, New Mexico (fig. 1). It is bordered by Union County and Harding County on the north, by Guadalupe County and San Miguel County on the west, by the Southern High Plains escarpment and a part of Curry County on the south, and by Oldham County, Deaf Smith County, and Hartley County in Texas on the east. The Area has a total of 1,412,120 acres, or approximately 2,206 square miles. This includes all of the Canadian River drainage basin in Quay County and the sloping upland areas of the High Plains north of the Canadian River. Elevation ranges from about 3,600 feet at the Canadian River and the Texas State line, to about 5,300 feet at the tops of mesas.

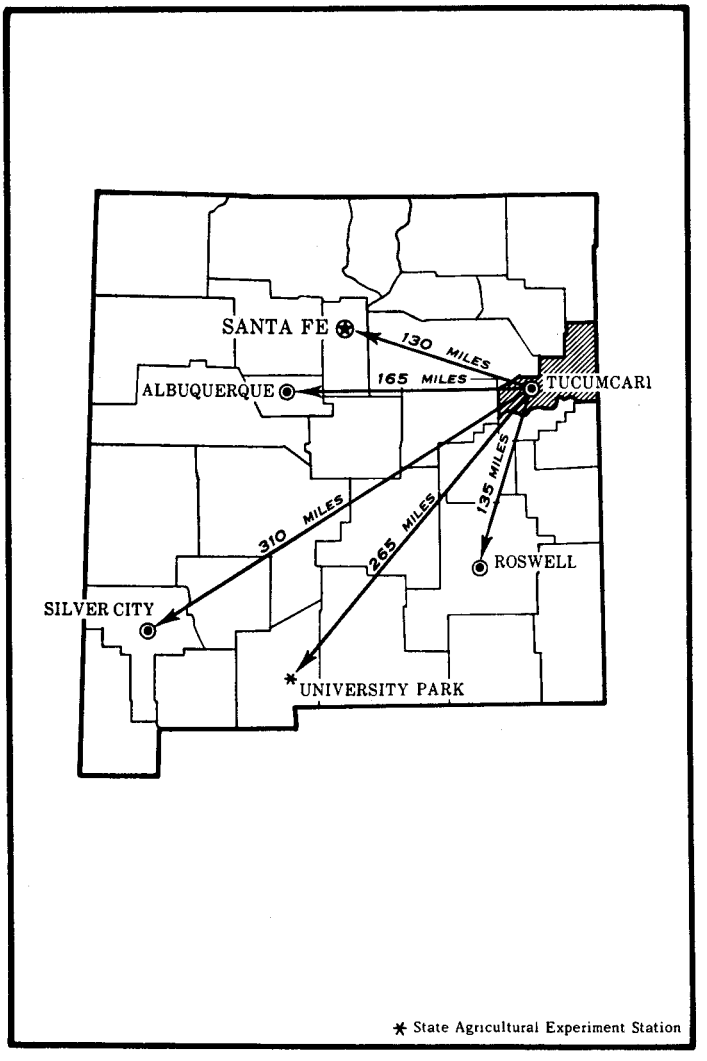

Figure 1.—Location of Tucumcari Area in New Mexico.

Tucumcari, the county seat, had a population of 7,189 in 1970. The town is a terminal point for the Southern Pacific and Rock Island Railroads. Other communities within the survey area are Logan, Montoya, Nara Visa, Norton, Porter, Quay, and San Jon. Two Federal highways, U.S. 54 and Interstate 40, traverse in a general east-west direction through the Area. Sections of six State Highways, Nos. 18, 39, 88, 93, 104, and 392, are also in the survey area.

About 85 percent of the land is range, and the rest is cropland. About 6 percent of the cropland is in irrigated crops, and about 9 percent is in dryfarmed crops. The principal irrigated crops grown are alfalfa, cotton, grain sorghum, and wheat. Other irrigated crops grown are silage corn, truck crops, and melons. The principal dryfarmed crops are wheat, grain and forage sorghum, and broomcorn.

One artificial reservoir, Ute Reservoir, is in the Area. This reservoir was formed by a dam that was built just below the confluence of Ute Creek with the Canadian River. It is a good recreation site for both local residents and tourists. Several natural, wet-weather lakes are also in the survey area. The largest and best known of these are Tucumcari Lake and Hudson Lake.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Tucumcari Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they

had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in the counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*10*).[1]

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Tucumcari, Redona, and Tivoli, for example, are the names of three soil series in the Tucumcari Area. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Redona fine sandy loam, 0 to 3 percent slopes, is one of several phases within the Redona series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show roads, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and ranches, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of the Tucumcari Area: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Bascom-Potter loams, 1 to 9 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils joined by a hyphen. Springer-Amarillo association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Lacita silt loam and Gullied land is an undifferentiated soil group in this survey area.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock land is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date-knowledge of the soils and their behavior under current methods of use and management.

[1] Italic numbers in parentheses refer to Literature Cited, page 91.

Soil Survey Intensities

The Tucumcari Area, New Mexico, Northern Quay County soil survey required mixed mapping intensities to meet expected uses (fig. 2).

The irrigated cropland and urban areas around the town of Tucumcari were mapped at a high intensity of detail, and the dryfarmed cropland and rangeland were mapped at a medium intensity of detail. The mapping units that are soil associations or land types were surveyed mostly at medium intensity. These and other mapping units surveyed at medium intensity are less homogeneous than the mapping units surveyed at high intensity.

The soil symbol indicates the intensity of mapping. A soil mapped at high intensity is identified by a symbol consisting of a captail letter and a small letter. A soil mapped at medium intensity is identified by a symbol consisting of two capital letters.

The Guide to Mapping Units at the back of this soil survey is in two parts. One is for units mapped at high intensity, and the other for units mapped at medium intensity. For example, Redona loam, 0 to 1 percent slopes, was mapped at high intensity and is in that part of the Guide. Redona fine sandy loam, 0 to 3 percent slopes, was mapped at medium intensity and is in the other part. Redona loamy fine sand, 0 to 3 percent slopes, was mapped at both intensities and is in both parts.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Tucumcari Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in the Tucumcari Area do not in every case join the soil associations in Harding County, New Mexico. The Mansker-Portales association, Amarillo association, and Springer-Tivoli-Amarillo association in Harding County join with the Amarillo-Springer association and Tivoli-Springer-Dune land association in the Tucumcari Area. The soils correlated in the Mansker-Portales association in Harding County are of minor extent along the county line in the Tucumcari Area. The percentage composition of the various soils in other soil associations are reflected in name changes between the Tucumcari Area and Harding County.

Twelve soil asscociations are in the Tucumcari Area. Four of these are in the Southern High Plains Land Resource Area (*2*) where the soils are used mostly for range and dryfarmed crops. Seven of them are made up mostly of soils in the Pecos-Canadian Plains and Valleys Land Resource Area. In three of these seven associations, the soils are used mostly for range and irrigated crops. In the other four, they are used mostly for range. The only other association in the Area is made up mostly of rocky or stony land types and is in both the Southern High Plains and Pecos-Canadian Plains and Valleys Land Resource Areas. The land types in this association are used mostly for range.

The soil associations and the groups of soil associations in the Tucumcari Area are discussed in the following pages. The terms for texture used in the title of the associations apply to the texture of the surface layer. For example, in the title of association 1, the word "sandy" refers to the surface layer.

Areas Dominated by Soils of the Southern High Plains; Mainly Used for Range and Dryfarmed Crops

The soils in this group are mostly in the northeastern part of the Tucumcari Area, at elevations ranging from 3,800 to 4,800 feet. These soils formed under mid and tall grasses, forbs, and shrubs in mixed, loamy to sandy, old alluvium reworked in places by wind.

1. Amarillo-Springer association

Nearly level to gently rolling, deep, sandy and loamy soils on uplands

This association consists of well-drained soils that formed in wind-reworked alluvium. Slopes are 0 to 9 percent. The vegetation is mixed mid and tall grasses, shrubs, and forbs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 17 percent of the survey area. About 50 percent of the association is Amarillo soils, and about 30 percent is Springer soils. Minor soils make up the other 20 percent. The minor soils in this association are mainly the Brownfield, Bascom, and Gomez soils.

Amarillo soils are nearly level to gently sloping or gently undulating. They have a surface layer of reddish-brown fine sandy loam or loamy fine sand. The subsoil is reddish-brown sandy clay loam and yellowish-red heavy fine sandy loam, and the substratum is pink sandy clay loam that has a high content of lime.

Springer soils are dominantly gently undulating or gently rolling. They have a surface layer of reddish-brown loamy fine sand. The subsoil is reddish-brown fine sandy loam, and the substratum is reddish-brown loamy sand.

The soils of this association are used for range, as wildlife habitat, for watershed, and for dryfarmed crops. Water is mostly pumped by windmills and kept in stock tanks.

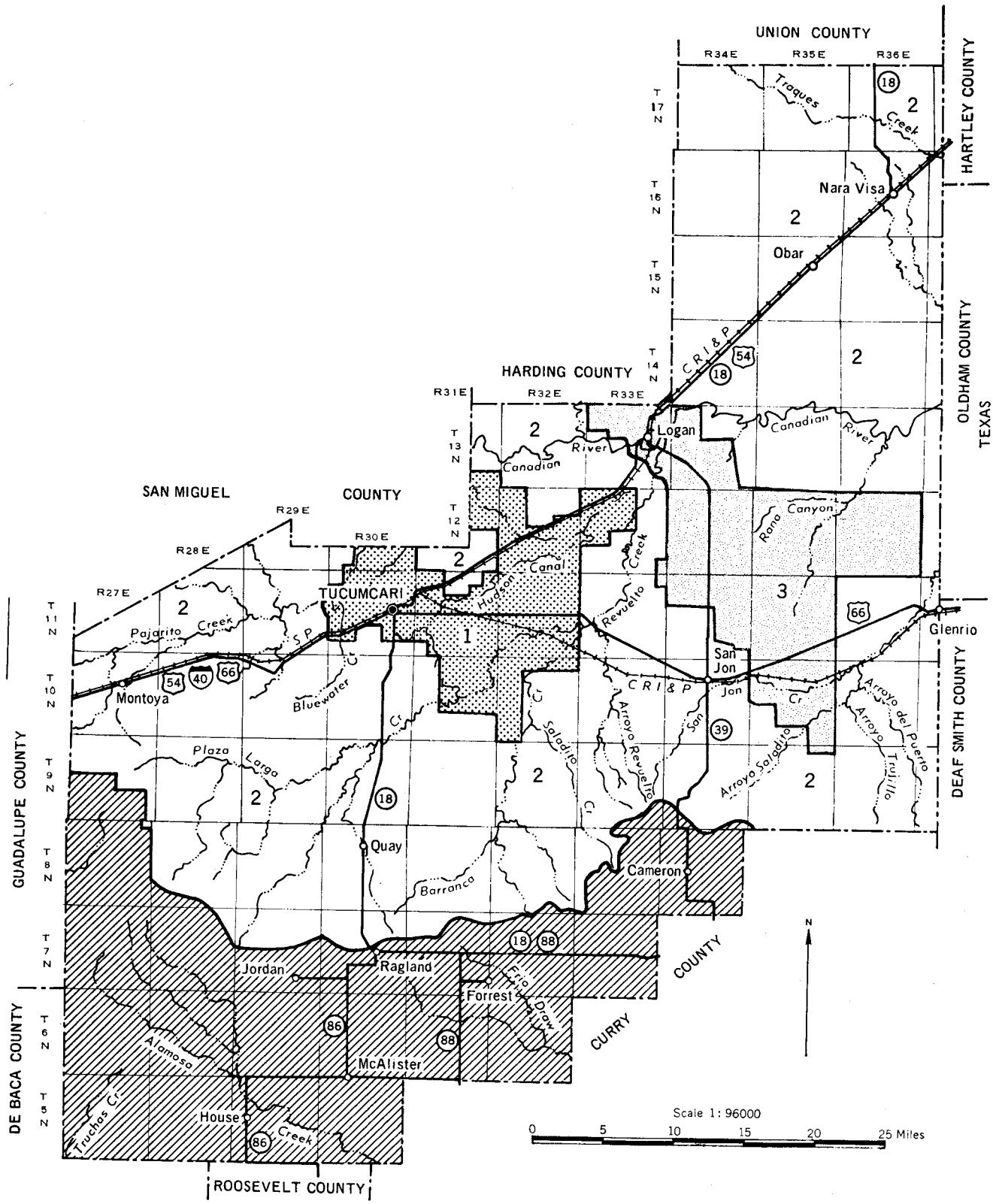

Figure 2.—Land use and survey intensities in Tucumcari Area: 1. Urban areas and major areas of irrigated cropland—high intensity. 2. Major areas of rangeland—medium intensity. 3. Major areas of dryfarmed cropland—medium intensity. The heavily shaded bottom section does not show intensity because it is out of the survey area.

Wildlife on the soils of this association consists of quail, mourning dove, antelope, rabbit, prairie dog, skunk, porcupine, and such predators as coyote, red fox, and bobcat.

The major dryfarmed crops grown on these soils are grain and forage sorghum and broomcorn.

The hazard of water erosion is slight, and the hazard of soil blowing is moderate to severe on these soils. Maintaining maximum plant cover, or a roughened surface layer, helps to control soil blowing. These are essential practices in some areas of this association.

2. *Bascom-Potter association*

Nearly level to gently sloping, deep loamy soils and gently rolling or strongly sloping, loamy soils that are shallow to cemented caliche; on uplands

This association consists of well-drained soils that formed in calcareous sediment or beds of caliche. Slopes are 0 to 9 percent. The vegetation is mixed mid and tall grasses and shrubs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 4 percent of the survey area. About 40 percent of the association is Bascom soils, and about 35 percent is Potter soils. Minor soils make up the other 25 percent. The minor soils in this association are the Olton, Amarillo, Springer, Ima, Quay, and Tucumcari.

Bascom soils are dominantly nearly level to gently sloping. They have a surface layer of brown and light-brown fine sandy loam that is calcareous. The underlying layer is pinkish-gray very gravelly fine sandy loam and the substratum is white fine sandy loam and pale-red loam having a high content of lime.

Potter soils are dominantly gently rolling or strongly sloping. They have a surface layer of brownish-gray loam over fractured cemented caliche at a depth of 6 to 10 inches.

The soils of this association are used for range, as wildlife habitat, and for watershed. A limited acreage of Olton soils is in dryfarmed crops; however, success of these crops is somewhat uncertain because of limited rainfall. Areas of Bascom and Potter soils in this association are used as a source of material for commercial roadfill.

Water comes mostly from runoff or is pumped by windmills and kept in storage tanks.

Wildlife on these soils consists mostly of quail, dove, antelope, rabbit, and common predators.

The hazard of erosion is moderate on the soils of this association.

3. *Tivoli-Springer-Dune land association*

Undulating to hilly, deep, sandy soils on uplands

This association consists of well-drained to excessively drained soils that formed in wind-worked alluvium on the High Plains. Slopes are 1 to 25 percent. The vegetation is mostly mixed mid and tall grasses and shrubs; however, most areas of Dune land in the association are without vegetation. Elevation ranges from 4,000 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 6 percent of the survey area. About 50 percent of the association is Tivoli soils, about 20 percent is Springer soils, and about 20 percent is Dune land. Minor soils make up the other 10 percent. The minor soils in this association are the Amarillo, Brownfield, Gallegos, and Gomez.

Tivoli soils are rolling to hilly. They have a surface layer of light-brown fine sand and underlying layers of reddish-yellow to pink fine sand.

Springer soils are undulating. They have a surface layer of reddish-brown loamy fine sand. The subsoil is reddish-brown fine sandy loam, and the substratum is reddish-brown loamy sand.

Dune land is rolling to hilly. This land type consists of accumulations of medium and fine sand that are moved about by wind.

The soils of this association are used for range and for wildlife habitat. Some blown-out areas are fair to good recreation sites, mostly for picnic grounds.

Most of the water is pumped by windmills and kept in steel storage tanks. Also, because of little or no runoff, this association is a good catchment area for rainfall. It returns maximum amounts of moisture to underground storage.

Wildlife on the soils of this association consists of game birds, antelope, rabbits, and rodents.

The hazard of soil blowing is severe on these soils. Careful management of livestock on areas used for range is essential in controlling this hazard.

4. *Amarillo-Ima association*

Nearly level to gently sloping or gently undulating, deep, loamy soils on uplands and alluvial fans

This association consists of well-drained soils that formed in mixed alluvium. Slopes are 0 to 5 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,600 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 6 percent of the survey area. About 55 percent of the association is Amarillo soils, and about 20 percent is Ima soils. Minor soils make up the other 25 percent. The minor soils in this association are the Bascom, Springer, Brownfield, Gomez, Los Tanos, and Minneosa.

Amarillo soils are nearly level to gently sloping and are on smooth topography. They have a surface layer of reddish-brown fine sandy loam. The subbsoil is reddish-brown sandy clay loam and yellowish-red heavy fine sandy loam, and the substratum is pink sandy clay loam that has a high content of lime.

Ima soils are gently sloping to gently undulating. They have a surface layer of reddish-brown sandy loam and fine sandy loam. The subsoil is light reddish-brown fine sandy loam, and the substratum is reddish-yellow very fine sandy loam.

The soils of this association are used for range, as

wildlife habitat, and for watershed. The Amarillo soils are also used for dryfarmed crops.

Ranches and farms are medium sized. Carrying capacities and water supplies are moderate. Water is mostly pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds formed by earthen dams. Runoff is mostly from the gently sloping soils.

Wildlife on the soils of this association consists mostly of antelope, scaled quail, and mourning dove.

The major dryfarmed crops grown on these soils are grain and forage sorghum and broomcorn.

The hazard of soil blowing is moderate on cropland or on range that is in poor condition. Maintaining maximum plant cover on areas used for range and using practices that conserve soil and water on dryfarmed cropland are ways of helping to control soil blowing.

Areas Dominated by Rocky or Stony Land Types; Mainly Used for Range

The land types in this group are along breaks of the Canadian River and escarpments between the High Plains uplands and the lower lying valleys. These land types are at elevations ranging from 3,600 to 5,000 feet. Vegetation is short and mid grasses, shrubs, and juniper. Only one association is in this group. It is in the southern and north-central parts of the Tucumcari Area.

5. Rock land-Rough broken and stony land association

Hilly to very steep, very shallow and shallow, rocky and stony land types

This association consists of areas of steep and very steep canyon walls adjacent to the Canadian River and steep to very steep escarpments between the High Plains uplands and the lower valleys. Slopes are 9 to 80 percent. The vegetation is short and mid grasses, shrubs, and juniper. Elevation ranges from 3,600 to 5,000 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 12 percent of the survey area. About 60 percent of the association is Rock land, and about 15 percent is Rough broken and stony land. Minor soils make up the other 25 percent. The minor soils in this association are the Gallegos, Latom, Los Tanos, Canez, and Ima.

Rock land is steep to very steep. This land type consists of sandstone and caliche outcrops and stony soils that are very shallow to shallow over bedrock. The areas of this land type include many deep canyons.

Rough broken and stony land is hilly to steep. This land type consists of shale breaks, stone-covered, sloping soils, remnants of eroded terraces, and short alluvial fans. The areas of this land type are dissected by numerous gullies.

The land types and soils of this association are used for range, as wildlife habitat, for watershed, and for recreation.

Ranches are medium sized to large. Carrying capacities are low, and water supplies are limited. Water is mostly from developed springs. It is kept in ranch ponds in the small canyons of this association.

Wildlife in the areas of this association consists mostly of deer. Some areas afford good protection to animals, both wildlife and livestock, during severe storms.

Indian ruins and artifacts can be found throughout all parts of this association. Ute Reservoir in the association is a good recreation site, mostly for fishing, boating, and swimming.

The hazard of water erosion is severe on range that is in poor condition. Maintaining maximum plant cover and constructing properly designed stock trails on areas used for range are ways of helping to control this hazard.

Areas Dominated by Soils of the Pecos-Canadian Plains and Valleys; Mainly Used for Range and Irrigated Crops

The soils in this group are mostly in the southern part of the Tucumcari Area at elevations ranging from 3,800 to 4,800 feet. These soils formed under short, mid, and tall grasses, forbs, and shrubs in sandy to clayey alluvium.

6. Quay-Montoya-Lacita association

Nearly level to strongly sloping, deep, loamy soils on alluvial fans, low terraces, and flood plains

This association consists of well-drained soils that formed in alluvium derived principally from red-bed material. Slopes are 0 to 9 percent. The vegetation is short and mid grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 22 percent of the survey area. About 30 percent of the association is Quay soils, 25 percent is Montoya soils, and 15 percent is Lacita soils. Minor soils make up the other 30 percent. The minor soils in this association are the Kinkead, Ima, La Lande, Redona, Canez, Toyah, San Jon, and Los Tanos.

Quay soils are nearly level to strongly sloping and are on upland alluvial fans. They have a surface layer of reddish-brown and light reddish-brown loam. The subsoil is light reddish-brown and reddish-brown clay loam, and the substratum is light-brown and pinkish-gray clay loam that has a high content of lime.

Montoya soils are nearly level to gently sloping and are on channeled flood plains and low terraces. They have a surface layer of reddish-brown clay loam. The subsoil and the substratum are reddish-brown clay.

Lacita soils are nearly level to gently sloping and are on upland alluvial fans. They have a surface layer of light reddish-brown silt loam over a layer of reddish-yellow silt loam. The substratum is light reddish-brown, reddish-brown, and pink heavy silt loam to silty clay loam.

The soils of this association are used for range and as wildlife habitat. They are also used for watershed and irrigated crops.

Ranches are large, and carrying capacities are moder-

ate. Water supplies are limited. Water for livestock is pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds formed by earthen dams. Runoff comes mostly from the strongly sloping Quay soils and gullied areas of the Montoya and Lacita soils. Water for irrigation comes by gravity flow from Conchas Reservoir, about 30 miles northwest of Tucumcari in San Miguel County.

Wildlife on the soils of this association consists of antelope, scaled quail, mourning dove, and some waterfowl.

Irrigated cotton, alfalfa, grain sorghum, and wheat are grown principally on Quay, Montoya, and Lacita soils.

The hazard of soil blowing is moderate on cropland or on range that is in poor condition. The hazard of water erosion is moderate to severe. Maintaining maximum plant cover on areas used for range and using practices that conserve soil and water on irrigated cropland are ways of helping to control erosion. Properly planned irrigation systems on cropland help to conserve both soil and moisture.

This association has gullying and soil piping in places, mostly in the Montoya and Lacita soils.

7. *Ima-Tucumcari association*

Nearly level to gently undulating or gently sloping, deep, loamy soils on alluvial fans

This association consists of well-drained soils that formed in alluvium derived from red-bed material. Slopes are 0 to 5 percent. The vegetation is short, mid, and tall grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,600 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 4 percent of the survey area. About 55 percent of the association is Ima soils, and about 20 percent is Tucumcari soils. Minor soils make up the other 25 percent. The minor soils in this association are the Lacita, La Lande, Kinkead, Los Tanos, and Bascom.

Ima soils are gently sloping to gently undulating and are on alluvial fans. They are calcareous throughout and have a surface layer of reddish-brown sandy loam and fine sandy loam. The subsoil is light reddish-brown fine sandy loam, and the substratum is reddish-yellow very fine sandy loam.

Tucumcari soils are nearly level to gently sloping and are on concave alluvial fans. They are calcareous throughout, and have a surface layer of reddish-brown clay loam. The subsoil is reddish-brown heavy clay loam and heavy silty clay loam, and the sustratum is reddish-brown silty clay loam.

The soils of this association are used for range, as wildlife habitat, and for watershed. A small acreage is in irrigated crops.

Ranches are medium sized. Carrying capacities are moderate, and water supplies are limited. In areas of Ima soils, water is mostly pumped by windmills and kept in stock tanks. In areas of Tucumcari soils, water comes from runoff and is kept in ranch ponds formed by earthen dams. Water for irrigation comes by gravity flow from Conchas Reservoir, about 30 miles northwest of Tucumcari in San Miguel County.

Wildlife on the soils of this association consists mostly of antelope, scaled quail, and mourning dove.

Irrigated cotton, alfalfa, and grain sorghum are grown mostly on Tucumcari soils.

The hazard of soil blowing is severe on range that is in poor condition. Maintaining maximum plant cover on areas used for range helps to control this hazard. Properly designed irrigation systems help to conserve both soil and moisture on irrigated cropland.

8. *Redona-Canez association*

Nearly level to strongly sloping, deep, loamy and sandy soils on alluvial fans, terraces, and valley sides

This association consists of well-drained soils that formed in old alluvium modified in places by wind. Slopes are 0 to 9 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,000 to 4,600 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 11 percent of the survey area. About 55 percent of the association is Redona soils, and about 15 percent is Canez soils. Minor soils make up the other 30 percent. The minor soils in this association are the Quay, Ima, Tucumcari, Bascom, Gallegos, San Jose, and Montoya.

Redona soils are nearly level to gently sloping or gently undulating and are on upland alluvial fans and valley sides. They have a surface layer of reddish-brown fine sandy loam or loamy fine sand. The subsoil is reddish-brown sandy clay loam and pink to light reddish-brown clay loam, and the substratum is light reddish-brown and pink clay loam. The lower part of the subsoil and the substratum have a high content of lime.

Canez soils are nearly level to undulating or strongly sloping and are on upland alluvial fans and terraces. They have a surface layer of brown fine sandy loam or loamy fine sand and a subsoil of brown and reddish-brown sandy clay loam. Below the subsoil is brown and reddish-brown light sandy clay loam that is calcareous.

The soils of this association are used for range and irrigated crops, and as wildlife habitat.

Ranches and farms are medium sized to large. Carrying capacities are moderate, and water supplies are limited. Water is mostly pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in farm ponds formed by earthen dams. Water for irrigation comes by gravity flow from Conchas Reservoir, about 30 miles northwest of Tucumcari in San Miguel County.

Irrigated cotton, alfalfa, grain sorghum, and wheat are grown principally on nearly level to gently sloping Redona and Canez soils.

Wildlife on the soils of this association consists mostly of antelope, scaled quail, mourning dove, and some waterfowl.

The hazard of soil blowing is moderate to severe on cropland or range that is in poor condition. Maintaining maximum plant cover on areas used for range and using practices that conserve soil and water on irrigated cropland are ways of helping to control this hazard. Properly planned irrigation systems on cropland help to conserve both soil and moisture.

Areas Dominated by Soils of the Pecos-Canadian Plains and Valleys; Mainly Used for Range

The soils in this group are mostly in the southern part of the Tucumcari Area at elevations ranging from 3,800 to 5,000 feet. They formed under short and mid grasses, forbs, and shrubs in alluvium or material weathered from sandstone and shale.

9. Lacita-La Lande-Quay association

Nearly level to strongly sloping, deep, loamy soils on alluvial fans

This association consists of well-drained soils that formed in mixed alluvium. Slopes are 0 to 9 percent. The vegetation is short and mid grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 6 percent of the survey area. About 30 percent of the association is Lacita soils, about 20 percent is La Lande soils, and about 15 percent is Quay soils. Minor soils and land types make up the other 35 percent. These are Gullied land, Rough broken and stony land, and Ima, Tucumcari, Kinkead, San Jose, Gallegos, Los Tanos, Redona, and Bascom soils.

Lacita soils are nearly level to gently sloping and are on lower parts of alluvial fans. They are calcareous throughout and have a surface layer of light reddish-brown silt loam. The underlying layer is reddish-yellow silt loam, and the substratum is light reddish-brown, reddish-brown, and pink heavy silt loam to silty clay loam.

La Lande soils are nearly level to gently sloping and are on crests and sides of alluvial fans. They are calcareous throughout and have a brown and light-brown surface layer. The subsoil is brown clay loam, and the substratum is light-brown clay loam that grades to pink fine sandy loam.

Quay soils are nearly level to strongly sloping and are on upper parts of alluvial fans. They are calcareous throughout and have a surface layer of reddish-brown and light reddish-brown loam. The subsoil is light reddish-brown and reddish-brown clay loam, and the substratum is light-brown and pinkish-gray clay loam having a high content of lime.

The soils of this association are used for range, as wildlife habitat, and for watershed.

Ranches are large, carrying capacities are moderate, and water supplies are limited. Water is mostly pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds formed by earthen dams. Runoff comes mostly from the strongly sloping Quay soils and gullied areas of the Lacita soils.

Wildlife on the soil of this association consists mostly of antelope, scaled quail, and mourning dove.

The hazard of soil blowing is moderate on range that is in poor condition. The hazard of water erosion is moderate to severe. Maintaining maximum plant cover on areas used for range helps to control these hazards.

This association has gullying and soil piping in places, mostly in the Lacita soils.

10. Latom-Rock outcrop association

Sloping to steep, shallow and very shallow, stony soils and rock outcrop on upland ridges

This association consists of well-drained soils and of outcroppings of rock. The soils formed in material weathered from sandstone. Slopes are 3 to 50 percent or more. The vegetation is mid grasses, forbs, and shrubs. Elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 58° F. The frost-free season is 180 to 195 days.

This association makes up about 7 percent of the survey area. About 65 percent of the association is Latom soils, and about 20 percent is Rock outcrop. Minor soils and a land type make up the other 15 percent. These are Los Tanos, Canez, Ima, Gallegos, and Quay soils, and Rock land.

Latom soils are on tops and sides of ridges. They have a surface layer of light reddish-brown stony sandy loam and a substratum of reddish-brown sandy loam. Sandstone bedrock is at a depth of 6 to 20 inches.

Rock outcrop is on narrow sandstone escarpments and scattered bedrock exposures. This land type consists of outcroppings of sandstone bedrock.

The soils and land types of this association are used for range and watershed, and as wildlife habitat.

Ranches are mostly large, carrying capacities are low, and water supplies are limited. Water is generally pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds in the small canyons of this association. Runoff comes mostly from areas of rock outcroppings and areas where slopes are steep.

Wildlife on the areas of this association consists mostly of deer, antelope, quail, and dove.

The hazard of water erosion is moderate to severe on range that is in poor condition. Maintaining maximum plant cover on areas used for range helps to control this hazard.

11. San Jon-Los Tanos-Ima association

Gently sloping, moderately deep and deep, loamy soils on pediments, ridges, and alluvial fans

This association consists of well-drained soils that formed in material weathered from shale and sandstone and from alluvial sediment. Slopes are 1 to 5 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 4 percent of the survey area. About 40 percent of the association is San Jon soils, about 20 percent is Los Tanos soils, and about 15 percent is Ima soils. Minor soils and land types make up the other 25 percent. These are Rough broken and stony land, Gullied land, and Lacita, Montoya, Quay, La Lande, and San Jose soils.

San Jon soils are on erosional remnant pediments.

They are mostly calcareous and have a surface layer of reddish-brown loam. The underlying layer is reddish-brown, light reddish-brown, and red gravelly light clay loam to silty clay loam, and the substratum is red fragmental shale at a depth of 20 to 40 inches.

Los Tanos soils are on low hills, ridges, and mesas. They are mostly calcareous. The surface layer is light-brown sandy loam, and the subsoil is reddish-brown sandy loam. The substratum is reddish-yellow, partly weathered sandstone. Unweathered sandstone bedrock is at a depth of 20 to 40 inches.

Ima soils are on alluvial fans. They are mostly calcareous and have a surface layer of reddish-brown sandy loam and fine sandy loam. The subsoil is light reddish-brown fine sandy loam, and the substratum is reddish-yellow very fine sandy loam.

The soils of this association are used for range, as wildlife habitat, and for watershed.

Ranches are large, carrying capacities are low, and water supplies are limited. Water is generally pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds. Runoff comes mostly from the San Jon soils.

Wildlife on the soils of this association consists mostly scaled quail, mourning dove, and antelope.

The hazard of soil blowing is moderate on range that is in poor condition. The hazard of water erosion is severe on San Jon soils and moderate on Los Tanos and Ima soils. Maintaining maximum plant cover on areas used for range helps control soil blowing and water erosion.

12. Gallegos association

Gently undulating to hilly, deep, gravelly soils on old terraces

This association consists of well-drained soils that formed in gravelly alluvium. Slopes are 1 to 25 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

This association makes up about 1 percent of the survey area. About 70 percent of the association is Gallegos soils. Minor soils and a land type make up the other 30 percent. These are Latom, Ima, and Quay soils and Rock outcrop.

Gallegos soils have a surface layer and subsoil of brown very gravelly loam. The substratum is pink and pinkish-white very gravelly loam.

The soils of this association are used for range and watershed, as wildlife habitat, and as a source of construction material.

Ranches are large, carrying capacities are moderately low, and water supplies are limited. Water is generally pumped by windmills and kept in stock tanks, or it comes from runoff and is kept in ranch ponds formed by earthen dams in the drainageways of this association. Runoff comes mostly from areas where soils are more strongly sloping.

Wildlife on the soils of this association consists mostly of deer, antelope, scaled quail, and mourning dove.

Gravel pits have been dug in these soils in places to furnish material for highway construction.

Descriptions of the Soils

This section describes the soil series and the mapping units in the Tucumcari Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Unless otherwise stated, all soil color and consistence terms given are for dry condition. Reaction [pH] is by field indicator for a dilution of about one part soil to five parts indicator solution. Thickness variations given are for horizons in the survey area.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Dune land and Riverwash, for example, do not belong to a soil series, but nevertheless are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability subclass or unit, the range site, and the wildlife habitat group in which the mapping unit has been placed. The page for the description of each capability unit or subclass, range site, and wildlife habitat group can be learned by referring to the "Guide to Mapping Units" at the back of this survey. An explanation of soils and land types mapped at "high" and "medium" intensities is given in the section "Soil Survey Intensities."

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*10*).

Descriptions, names and delineations of soils in this soil survey do not fully agree with soil maps in adjacent counties published at a different date. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, and the extent of soils within the survey. In some places it is more feasible to combine small acreages of similar soils that respond to use and management in much the same way than it is to separate these soils and give them names.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	Area		Extent
	High intensity	Medium intensity	
	Acres	*Acres*	*Percent*
Amarillo loamy fine sand, 0 to 3 percent slopes		66,036	4.7
Amarillo loamy fine sand, eroded		5,929	.4
Amarillo fine sandy loam, 0 to 3 percent slopes		84,732	6.0
Bascom fine sandy loam, 0 to 3 percent slopes		9,337	.7
Bascom fine sandy loam, 3 to 9 percent slopes		5,655	.4
Bascom loam, 0 to 3 percent slopes		11,821	.8
Bascom loam, 3 to 9 percent slopes		4,885	.3
Bascom complex		10,286	.7
Bascom-Potter fine sandy loams, 1 to 9 percent slopes		14,574	1.0
Bascom-Potter loams, 1 to 9 percent slopes		23,361	1.6
Bascom-Potter complex, 1 to 9 percent slopes	259		(1)
Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes		1,309	.1
Bascom loam, nongravelly variant, 0 to 3 percent slopes		2,405	.2
Brownfield fine sand, 0 to 3 percent slopes		12,327	.9
Brownfield fine sand, eroded		2,775	.2
Canez loamy fine sand, 0 to 3 percent slopes	1,801		.1
Canez loamy fine sand, 1 to 5 percent slopes		5,974	.4
Canez loamy fine sand, 3 to 9 percent slopes	913		.1
Canez loamy fine sand, 0 to 3 percent slopes, hummocky	597		(1)
Canez fine sandy loam, 0 to 3 percent slopes	2,466		.2
Canez fine sandy loam, 1 to 5 percent slopes		12,599	.9
Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes	2,026	2,082	.3
Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes	1,128		.1
Canez loam, calcareous variant, 0 to 3 percent slopes		1,110	.1
Dune land		17,911	1.3
Gallegos very gravelly loam, 1 to 9 slopes		16,583	1.2
Gallegos very gravelly loam, 9 to 25 percent slopes	163	30,395	2.2
Gallegos complex, 3 to 9 percent slopes	1,594		.1
Gomez loamy fine sand, 0 to 3 percent slopes	705	3,435	.3
Gullied land, San Jon material		9,789	.7
Ima sandy loam, 1 to 3 percent slopes	3,119		.2
Ima sandy loam, 1 to 5 percent slopes		76,523	5.4
Ima sandy loam, 3 to 5 percent slopes	3,030		.2
Kinkead clay loam, 0 to 1 percent slopes	280		(1)
Kinkead clay loam, 0 to 3 percent slopes		14,738	1.0
Kinkead clay loam, 1 to 3 percent slopes	199		(1)
Lacita silt loam, 0 to 1 percent slopes	1,120		0.1
Lacita silt loam, 0 to 3 percent slopes		70,519	5.0
Lacita silt loam, 1 to 3 percent slopes	2,249		.2
Lacita silt loam and Gullied land		4,473	.3
La Lande fine sandy loam, 0 to 1 percent slopes	506		(1)
La Lande fine sandy loam, 1 to 3 percent slopes	734		.1
La Lande fine sandy loam, 1 to 5 percent slopes		3,758	.3
La Lande loam, 0 to 1 percent slopes	499		(1)
La Lande loam, 1 to 3 percent slopes	917		.1
La Lande loam, 0 to 5 percent slopes		27,326	1.9
La Lande loam, 3 to 5 percent slopes	412		(1)
Latom stony loam, 3 to 9 percent slopes	1,202		.1
Latom stony sandy loam, 3 to 9 percent slopes		41,262	2.9
Latom-Rock outcrop complex, hilly		14,405	1.0
Latom-Rock outcrop complex, steep		33,562	2.4
Los Tanos sandy loam, 1 to 5 percent slopes	1,521	28,803	2.1
Minneosa loamy fine sand	1,217	4,056	.4
Montoya clay loam		73,887	5.2
Montoya clay loam, 0 to 1 percent slopes	6,386		.5
Montoya clay loam, 1 to 3 percent slopes	4,219		.3
Montoya clay loam and Gullied land		2,974	.2
Olton loam, 0 to 3 percent slopes		13,727	1.0
Potter loam, 1 to 9 percent slopes	251	10,608	.8
Quay fine sandy loam, 0 to 1 percent slopes	703		(1)
Quay fine sandy loam, 1 to 3 percent slopes	2,556		.2
Quay loam, 0 to 1 percent slopes	6,071		.4
Quay loam, 1 to 3 percent slopes	9,281		.7
Quay loam, 0 to 5 percent slopes		112,272	7.9
Quay loam, 3 to 9 percent slopes	1,150		.1
Quay loam, sandstone substratum, 0 to 1 percent slopes	885		.1
Quay loam, sandstone substratum, 1 to 3 percent slopes	991		.1
Quay loam, shale substratum, 1 to 3 percent slopes	1,037		.1
Quay loam, shale substratum, 1 to 5 percent slopes		5,263	.4
Redona loamy fine sand, 0 to 3 percent slopes	5,947	4,855	.8
Redona loamy fine sand, 0 to 3 percent slopes, eroded		6,163	.4
Redona loamy fine sand, 3 to 5 percent slopes	613		(1)
Redona loamy fine sand, 0 to 3 percent slopes, hummocky	1,298		.1
Redona fine sandy loam, 0 to 1 percent slopes	4,545		.3
Redona fine sandy loam, 0 to 3 percent slopes		56,255	4.0
Redona fine sandy loam, 1 to 3 percent slopes	10,680		.7
Redona loam, 0 to 1 percent slopes	3,656		.3
Redona loam, 1 to 3 percent slopes	2,237		.2

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Mapping unit	Area		Extent	Mapping unit	Area		Extent
	High intensity	Medium intensity			High intensity	Medium intensity	
	Acres	*Acres*	*Percent*		*Acres*	*Acres*	*Percent*
Riverwash	1,048	7,829	0.6	Springer fine sandy loam, 0 to 3 percent slopes		10,380	0.7
Rock land	90	96,875	6.9	Springer fine sandy loam, 3 to 9 percent slopes		2,525	.2
Rough broken and stony land, hilly	666	9,465	.7	Tivoli fine sand		49,408	3.5
Rough broken and stony land, steep	1,142	11,552	.9	Toyah loam, 0 to 3 percent slopes	715	7,578	.6
San Jon loam, 1 to 5 percent slopes	3,006	26,530	2.1	Tucumcari clay loam, 0 to 1 percent slopes	1,494		.1
San Jose loam, 0 to 1 percent slopes	429		(1)	Tucumcari clay loam, 0 to 3 percent slopes		31,334	2.2
San Jose loam, 0 to 3 percent slopes		4,964	.4	Tucumcari clay loam, 1 to 3 percent slopes	967		.1
Sharvana sandy loam, 0 to 3 percent slopes		1,102	.1	Lakes	600	6,665	.5
Springer-Amarillo association		19,358	1.4	Total acres by intensity	101,320	1,310,800	
Springer loamy fine sand, 0 to 3 percent slopes		35,880	2.5	Total		1,412,120	100.0
Springer loamy fine sand, 0 to 3 percent slopes, eroded		6,626	.5				
Springer loamy fine sand, 3 to 9 percent slopes		21,990	1.5				

[1] Less than 0.05 percent.

Amarillo Series

The Amarillo series consists of deep, well-drained soils that formed in mixed alluvium on the High Plains. Slopes are 0 to 3 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,600 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Springer, Brownfield, and Tivoli series.

In a representative profile the surface layer is reddish-brown fine sandy loam about 8 inches thick. The subsoil is reddish-brown sandy clay loam and yellowish-red heavy fine sandy loam about 38 inches thick. The surface layer and the subsoil are noncalcareous. The substratum, to a depth of 60 inches or more, is pink sandy clay loam that has a high content of lime.

Permeability is moderate in these soils. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is about 60 inches.

Most areas of Amarillo soils are used for range and dryfarmed crops. The principal crops are grain, forage sorghum, and broomcorn. Some areas are used as wildlife habitat and for watershed.

Representative profile of Amarillo fine sandy loam, 0 to 3 percent slopes, NE¼NW¼NW¼ sec. 14, T. 15 N., R. 35 E.:

A1—0 to 8 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine and medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many very fine interstitial pores; noncalcareous; neutral (pH 7.2); clear, wavy boundary. 0 to 18 inches thick.

B2t—8 to 19 inches, reddish-brown (5YR 5/4) sandy clay loam, (5YR 4/4) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; slightly hard, friable when moist, slightly plastic and slightly sticky when wet; common fine roots; common fine and few medium tubular pores; very thin patchy clay films on ped faces; many worm casts; few fine pebbles; noncalcareous; mildly alkaline (pH 7.6); gradual, wavy boundary. 6 to 12 inches thick.

B3—19 to 46 inches, yellowish-red (5YR 5/6) heavy fine sandy loam (5YR 4/6) when moist; very coarse, moderate, prismatic structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; many very fine tubular pores; noncalcareous; mildly alkaline (pH 7.4); abrupt, smooth boundary. 12 to 38 inches thick.

C ca—46 to 60 inches, pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; massive; hard, friable when moist, slightly plastic and sticky when wet; few fine roots; many fine and few medium tubular pores; lime present as large prominent mycelia (more than 15 percent of horizon is calcium carbonate); strongly calcareous; moderately alkaline (pH 7.9).

Some fine, waterworn igneous gravel is present in all or in any part of the profile. Hue ranges from 5YR to 7.5YR throughout. The A horizon has a value of 4 or 5 when dry and of 3 or 4 when moist. It has a chroma of 3 or 4. The A horizon ranges from fine sandy loam to loamy fine sand. The B horizon ranges from loam to sandy clay loam or heavy fine sandy loam.

Amarillo loamy fine sand, 0 to 3 percent slopes (AL).—This soil is nearly level to gently undulating. It is on uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is loamy fine sand about 10 inches thick. Included in mapping were small tracts of Brownfield, Springer, and Tivoli soils.

Runoff is very slow on this soil, and the hazard of soil blowing is severe.

This Amarillo soil is used for range and dryfarmed crops, and as wildlife habitat. Dryland capability unit IVe-4; Deep Sand range site; wildlife habitat group B.

Amarillo loamy fine sand, eroded (0 to 3 percent slopes) (AM).—This soil is on abandoned farmland that

consists of a combination of dunes, hummocks, and blown-out areas on which cattle have destroyed much of the natural vegetation (fig. 3).

The profile of this soil is similar to that described as representative for the series, but the surface layer is loamy fine sand. The surface layer has been altered severely by soil blowing, and in places most or all of the original surface layer has been lost. In other places soil material has accumulated in the form of low dunes and hummocks. Included in mapping were small tracts of Brownfield and Springer soils.

Runoff is generally very slow on this Amarillo soil, but it ranges to medium in those areas where erosion has exposed the sandy clay loam subsoil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Amarillo fine sandy loam, 0 to 3 percent slopes (AR).—This soil is level to nearly level. It is on uplands of the High Plains.

This soil has the profile described as representative for the Amarillo series. Included in mapping, and making up about 15 percent of the mapped acreage, were areas of Springer, Potter, and Olton soils.

Runoff is slow on this Amarillo soil. The hazard of soil blowing is moderate.

This soil is used for range and dryfarmed crops, and as wildlife habitat. Dryland capability unit IIIe–1; Sandy range site; wildlife habitat group A.

Bascom Series

The Bascom series consists of deep, well-drained soils that formed in limy, medium-textured to moderately coarse textured sediment on the High Plains. Slopes are 0 to 9 percent. The vegetation is mixed mid and tall grasses, yucca, mesquite, and cholla cactus. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Redona and Potter series, and in the Canez variant.

In a representative profile the surface layer is brown and light-brown fine sandy loam about 16 inches thick. The next layer is pinkish-gray very gravelly fine sandy loam, about 20 inches thick, that has a high content of lime. Below this is white fine sandy loam and pale-red loam that have a high content of lime. The soil is strongly calcareous throughout the profile.

Permeability is moderately rapid in the Bascom soils. Available water holding capacity is 2 to 3 inches. Effective rooting depth to the strong lime zone is 12 to 20 inches.

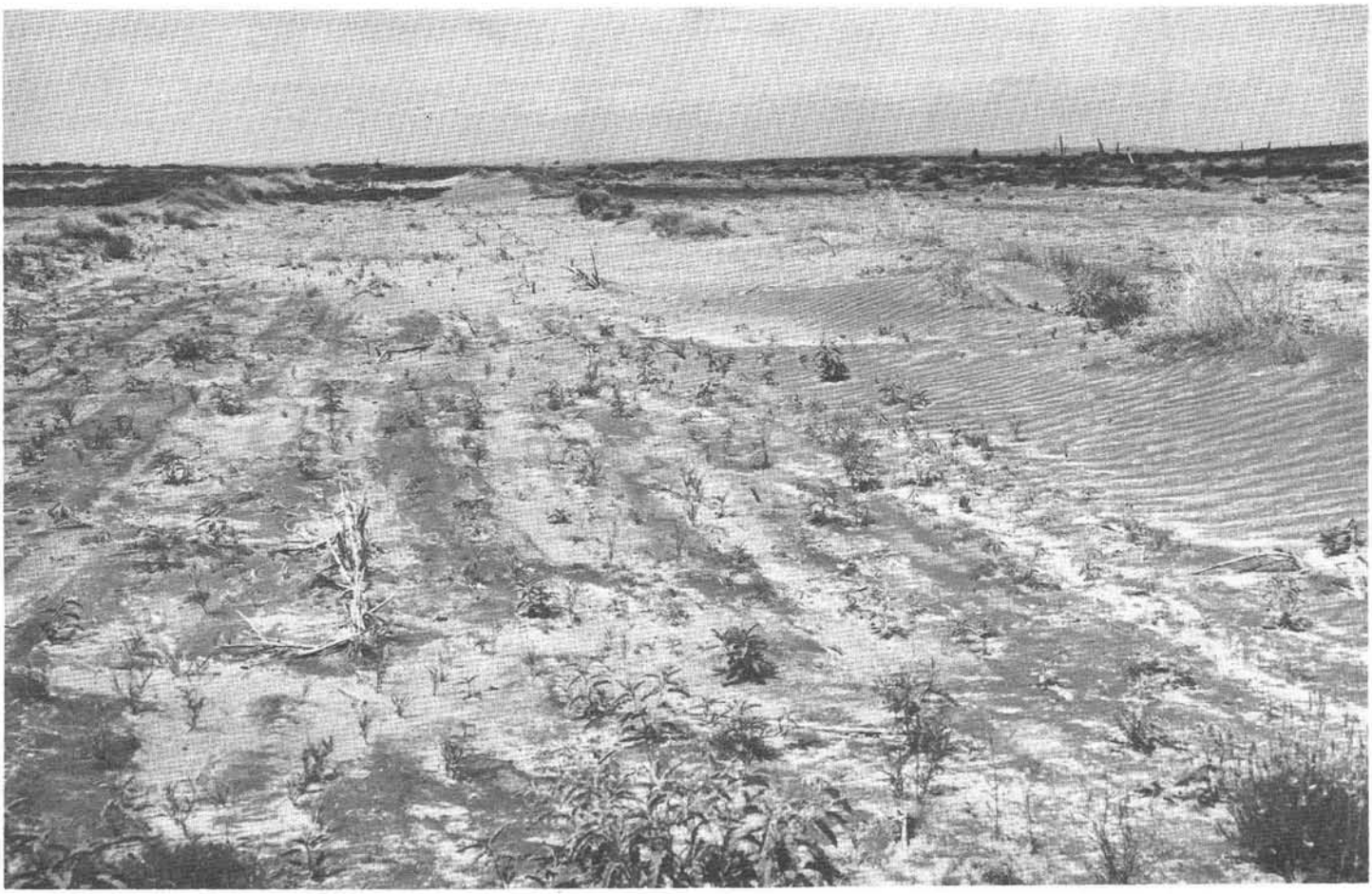

Figure 3.—Hummocks and blown-out areas of Amarillo loamy fine sand, eroded.

Most areas of these soils are used for range and watershed, and as wildlife habitat. Limited acreages are in irrigated crops. Some areas are used as a source of construction material.

Representative profile of Bascom fine sandy loam in an area of Bascom complex, one-fourth mile west and one-fourth mile north of the southeast corner of sec. 31, T. 12 N., R. 35 E.:

A11—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, (7.5YR 4/4) when moist; weak, thick, platy, structure in upper ½ to 1 inch and weak, fine, granular below; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; common fine and very fine vesicular pores; few, very hard, subrounded lime nodules as much as 20 millimeters long; strongly calcareous; moderately alkaline (pH 8.0); clear, wavy boundary. 6 to 12 inches thick.

A12—8 to 16 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; common fine and very fine tubular pores; few, very hard, subrounded lime nodules as much as 30 millimeters long; strongly calcareous; moderately alkaline (pH 8.2); abrupt, wavy boundary. 6 to 8 inches thick.

C1ca—16 to 36 inches, pinkish-gray (7.5YR 7/2) very gravelly fine sandy loam, (7.5YR 6/2) when moist; weak, fine, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; very few fine tubular pores; about 55 percent coarse fragments of strongly cemented lime as much as 75 millimeters long, interiors nearly white; strongly calcareous; strongly alkaline (pH 8.5); abrupt, irregular boundary. 20 to 30 inches thick.

C2ca—36 to 48 inches, white (7.5YR 8/1) fine sandy loam, pinkish white (7.5YR 8/2) when moist; massive; very hard, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; very few, very fine, random tubular pores; strongly calcareous; strongly alkaline (pH 8.5); abrupt, smooth boundary. 8 to 14 inches thick.

C3—48 to 72 inches, pale-red (10R 6/3) loam, (10R 6/4) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; common fine tubular pores; few nodules of white lime embedded in matrix, and content of lime less than that in overlying horizon; strongly calcareous; strongly alkaline (pH 8.6).

In the A horizon hue ranges from 10YR to 7.5YR, and chroma is 3 or 4. This horizon is fine sandy loam to loam. The C1ca horizon ranges from very gravelly fine sandy loam to very gravelly loam or very gravelly light sandy clay loam. The C1ca horizon begins at a depth of 12 to 20 inches.

Bascom fine sandy loam, 0 to 3 percent slopes (BA).—This soil is level to nearly level. It is on uplands.

The profile of this soil is similar to that described as representative for the Bascom series, but the surface layer is fine sandy loam about 14 inches thick.

Included with this soil in mapping were areas of Potter, San Jon, Amarillo, and Olton soils, and areas of Canez soils, calcareous variant. These included areas make up about 10 percent of the mapped acreage of this soil.

Runoff is slow on this Bascom soil. The hazard of soil blowing is moderate.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Bascom fine sandy loam, 3 to 9 percent slopes (BB).—This soil is gently sloping to moderately sloping. It is on uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is heavy fine sandy loam about 14 inches thick.

Included with this soil in mapping were small tracts of Potter and San Jon soils, and of Canez soils, calcareous variant.

Runoff is medium on this Bascom soil. The hazard of erosion is moderate.

This soil is used for range and watershed, and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Bascom loam, 0 to 3 percent slopes (BC).—This soil is level to nearly level. It is on uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is loam about 16 inches thick.

Included with this soil in mapping were areas of Redona and Potter soils, and of Canez soils, calcareous variant. These included areas make up about 15 percent of the mapped acreage of this soil.

Runoff is medium on this Bascom soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range and watershed, and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Bascom loam, 3 to 9 percent slopes (BD).—This soil is gently sloping to moderately sloping. It is on uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is loam about 14 inches thick. Included in mapping were small tracts of Potter and Redona soils.

Runoff is rapid on this Bascom soil. The hazard of water erosion is moderate to severe, and the hazard of soil blowing is moderate.

This soil is used for range and watershed, and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Bascom complex (1 to 5 percent slopes) (BE).—Bascom fine sandy loam makes up about 45 percent of this complex. Canez fine sandy loam, calcareous variant, makes up about 40 percent. Included soils make up the other 15 percent. The Bascom soil is nearly level to gently sloping, and the Canez soil is nearly level.

The Bascom soil has the profile described as representative for the Bascom series.

Included with these soils in mapping were areas of Potter, Amarillo, and La Lande soils.

Runoff is medium on the Bascom soil, and the hazards of soil blowing and water erosion are moderate. Runoff is slow on the Canez soil, calcareous variant, and the hazard of soil blowing is moderate.

The soils of this complex are used for range and watershed, and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Bascom-Potter fine sandy loams, 1 to 9 percent slopes (BF).—Bascom fine sandy loam makes up about 50 percent of this complex, and Potter fine sandy loam makes up about 40 percent. Included soils make up the other 10 percent. The Bascom soil is nearly level to gently slop-

ing. The Potter soil is on ridges and knolls and is gently sloping to moderately sloping.

The Bascom soil has a profile similar to that described as representative for the Bascom series, but the surface layer is fine sandy loam about 14 inches thick. The Potter soil has a profile similar to that described as representative for the Potter series, but the surface layer is fine sandy loam about 8 inches thick.

Included with these soils in mapping were areas of Canez soils, calcareous variant, and of Redona soils.

Runoff is slow to medium on the Bascom soil, and the hazards of soil blowing and water erosion are moderate. Runoff is medium on the Potter soil, and the hazard of water erosion is moderate.

The soils of this complex are used for range and watershed, as wildlife habitat, and as a source of construction material. Dryland capability subclass VIe; Bascom soil in Sandy range site, Potter soil in Shallow range site; both soils in wildlife habitat group C.

Bascom-Potter loams, 1 to 9 percent slopes (BG).—Bascom loam makes up about 45 percent of this complex, Potter loam about 40 percent, and included soils the other 15 percent. The Bascom soil is nearly level to gently sloping. The Potter soil is on low ridges and knolls and is gently sloping to moderately sloping.

The Bascom soil has a profile similar to that described as representative for the Bascom series, but the surface layer is loam about 14 inches thick.

Included with these soils in mapping were areas of Kinkead, San Jon, Redona, and Olton soils, and areas of Canez soils, calcareous variant.

Runoff is medium on the Bascom soil, and the hazards of soil blowing and water erosion are moderate. Runoff is rapid on the Potter soil, and the hazards of water erosion is moderate.

The soils of this complex are used for range and watershed, as wildlife habitat, and as a source of construction material. Dryland capability subclass VIe; Bascom soil in Sandy range site, Potter soil in Shallow range site; both soils in wildlife habitat group C.

Bascom-Potter complex, 1 to 9 percent slopes (Bh).—Bascom loam makes up about 25 percent of this complex, Bascom fine sandy loam about 20 percent, Potter loam about 20 percent, and Potter fine sandy loam about 15 percent. Included soils make up the remaining 20 percent. The Bascom soils are nearly level to gently sloping. The Potter soils are on low ridges and knolls and are gently sloping to moderately sloping.

The Bascom soils have a profile similar to that described as representative for the Bascom series, but the surface layer is loam or fine sandy loam about 14 inches thick. The Potter soils have a profile similar to that described as representative for the Potter series, but the surface layer is loam or fine sandy loam about 8 inches thick.

Included with these soils in mapping were areas of Redona and La Lande soils, and of Canez soils, calcareous variant.

Runoff is medium on the Bascom soils, and the hazards of soil blowing and water erosion are moderate. Runoff is rapid on the Potter soils, and the hazard of water erosion is moderate.

The soils of this complex are used for range and watershed, as wildlife habitat, and as a source of construction material. Dryland capability subclass VIe; Bascom soil in Sandy range site, Potter soil in Shallow range site; both soils in wildlife habitat group C.

Bascom Variant

The Bascom variant consists of deep, well-drained, nongravelly soils that formed in mixed wind- and water-laid sediment on the High Plains. Slopes are 0 to 3 percent. The vegetation is mid grasses, shrubs, and forbs. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Bascom, Redona, and Potter series, and in the Canez variant.

In a representative profile the surface layer is light-brown fine sandy loam and loam about 13 inches thick. The subsoil is brown sandy clay loam about 16 inches thick. The substratum is very pale brown fine sandy loam and grayish-brown clay loam and extends to a depth of 60 inches or more. The soil is noncalcareous above a depth of 6 inches.

Permeability is moderate in these soils. Available water holding capacity is 4 to 5 inches. Effective rooting depth to the strong lime zone is 20 to 40 inches.

Bascom soils, nongravelly variant, are used for range and watershed and as wildlife habitat. They are also used for dryfarmed crops to a limited extent.

Representative profile of Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes, SW¼NW¼SE¼ sec. 10, T. 14 N., R. 35 E.:

A11—0 to 6 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak, coarse, subangular blocky structure that parts to weak, coarse, granular; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine tubular pores; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 4 to 8 inches thick.

A12—6 to 13 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine tubular pores; slightly calcareous; mildly alkaline (pH 7.6); clear, smooth boundary. 4 to 8 inches thick.

B2ca—13 to 29 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, prismatic structure; hard, friable when moist, sticky and plastic when wet; common fine roots; few fine tubular pores; few, distinct, soft masses of white lime; strongly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary. 10 to 22 inches thick.

IIC1ca—29 to 35 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; very weak, subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; few fine tubular pores; few, faint, soft masses of lime; strongly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary. 0 to 8 inches thick.

IIIC2ca—35 to 60 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; massive; hard, firm when moist, sticky and plastic when wet; few fine roots; few fine tubular pores; common, distinct, soft masses of white lime; (more than 15 percent calcium carbonate equivalent); strongly calcareous; moderately alkaline (pH 8.4).

The A horizon ranges from fine sandy loam to loam. The B horizon ranges from loam to sandy clay loam.

Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes (BK).—This soil is level to nearly level. It is on slightly concave uplands.

This soil has the profile described as representative for the Bascom series, nongravelly variant. Included in mapping were small tracts of Bascom, Gomez, and Amarillo soils.

Runoff is slow on this soil, and the hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for watershed. A small acreage is in dryfarmed crops. Dryland capability unit IIIe-1; Sandy range site; wildlife habitat group A.

Bascom loam, nongravelly variant, 0 to 3 percent slopes (BM).—This soil is level to nearly level. It is on slightly concave uplands of the High Plains.

The profile of this soil is similar to that described as representative for the Bascom series, nongravelly variant, but it has a loam surface layer about 6 inches thick. Included in mapping were areas of Gomez soils and of Canez variant.

Runoff is medium on this soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. A small acreage is in dryfarmed crops. Dryland capability unit IIIec-1; Loamy range site; wildlife habitat group A.

Brownfield Series

The Brownfield series consists of deep, well-drained soils that formed in wind-reworked alluvium on the High Plains. Slopes are 0 to 3 percent. The vegetation is mid and tall grasses, sand sagebrush, yucca, and mesquite. Elevation ranges from 4,500 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air tempreature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Amarillo, Springer, and Tivoli series.

In a representative profile the surface layer is light-brown fine sand and light reddish-brown loamy sand about 20 inches thick. The subsoil and substratum to a depth of 63 inches or more are light reddish-brown fine sandy loam and sandy clay loam. The soil is noncalcareous to a depth of about 53 inches.

Permeability is moderate in these soils. Available water holding capacity is 6.5 to 8 inches. Effective rooting depth is 60 inches or more.

The Brownfield soils are used for range, as wildlife habitat, and for recreation.

Representative profile of Brownfield fine sand, 0 to 3 percent slopes, three-tenths mile west of bullseye in target area of old bombing range in sec. 22, T. 14 N., R. 36 E.:

A11—0 to 7 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; common fine roots; few fine interstitial pores; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 6 to 10 inches thick.

A12—7 to 20 inches, light reddish-brown (5YR 6/4) loamy sand, reddish brown (5YR 5/4) when moist; very weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 10 to 18 inches thick.

B1—20 to 24 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; very weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common fine and medium tubular pores; noncalcareous; neutral (pH 7.2); abrupt, smooth boundary. 0 to 10 inches thick.

B2t—24 to 34 inches, light reddish-brown (2.5YR 6/4) sandy clay loam, reddish brown (2.5YR 5/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; common fine and few medium tubular pores; common moderately thick clay films on ped surfaces; few fine waterworn pebbles; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 8 to 14 inches thick.

B3—34 to 53 inches, light reddish-brown (2.5YR 6/4) sandy clay loam, reddish brown (2.5YR 5/4) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and slightly plastic when wet; few fine roots; few fine tubular pores; few fine waterworn pebbles; noncalcareous; neutral (pH 7.0); abrupt, smooth boundary. 12 to 20 inches thick.

Cca—53 to 63 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; weak, medium, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; common fine and medium tubular pores; common, medium, prominent mottles of lime; moderately calcareous; mildly alkaline (pH 7.6).

Variegated colors are common in the B2t horizon. A distinct Cca horizon is present in places below a depth of 36 inches. Layers of loamy sand or sandy loam are common below a depth of 40 inches.

Brownfield fine sand, 0 to 3 percent slopes (BN).—This soil is nearly level to gently undulating. It is on upland plains.

This soil has the profile described as representative for the Brownfield series.

Included with this soil in mapping were small areas of Springer, Amarillo, and Gomez soils, and small areas of soils having a surface layer of fine sand 15 to 20 inches thick.

Runoff is very slow on this Brownfield soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Brownfield fine sand, eroded (0 to 3 percent slopes) (BO).—This soil is on upland plains east of Logan in abandoned fields that were formerly used for dryfarmed crops.

The profile of this soil is similar to that described as representative for the Brownfield series, but the surface layer has been altered and, in places, entirely removed by soil blowing.

About 55 percent of this mapping unit consists of low hummocks of accumulated fine sand, mostly along the northern, northeastern, and eastern edges of the old fields. The hummocks are 24 to 48 inches thick over a sandy clay loam subsoil. About 25 percent of the unit consists of areas where the surface layer has been blown away and the sandy clay loam subsoil has been exposed (fig. 4).

Figure 4.—**On this Brownfield fine sand, eroded, the surface layer has been blown away and the sandy clay loam subsoil exposed.**

Included with this soil in mapping were areas of Springer, Amarillo, and Tivoli soils. These included areas make up about 20 percent of the mapped acreage of this soil.

Runoff is slow on this Brownfield soil. The hazard of soil blowing is severe. Soil blowing is common in the more barren areas and less common in places where the soil is better stabilized by vegetation.

This soil is used for range, as wildlife habitat, and for recreation. Dryland capability subclass VIIe; Deep Sand range site; wildlife habitat group B.

Canez Series

The Canez series consists of deep, well-drained soils that formed in alluvium derived primarily from sandstone. They are on alluvial fans and terraces. Slopes are 0 to 9 percent. The vegetation is mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,000 to 4,600 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Ima and Quay series.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The subsoil is brown sandy clay loam and reddish-brown light sandy clay loam about 40 inches thick. Below the subsoil and extending to a depth of 67 inches or more is brown and reddish-brown light sandy clay loam that contains some segregated lime. The surface layer and subsoil are noncalcareous.

Permeability is moderate in these soils. Available water holding capacity is 8.5 to 9.5 inches. Effective rooting depth is 60 inches or more.

These Canez soils are used for range, as wildlife habitat, for irrigated crops, and for watershed. They are dry too much of the time to be suitable for dryfarmed crops.

Representative profile of Canez fine sandy loam, 1 to 5 percent slopes, 50 feet west of the canal bridge in the northwest corner of sec. 8, T. 11 N., R. 30 E.:

A1—0 to 8 inches, brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; weak, thick, platy structure in upper 2 inches that grades to weak, fine, granular in lower part; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common very fine vesicular pores; noncalcareous; neutral (pH 7.0); clear, smooth boundary. 5 to 18 inches thick.

B2t—8 to 22 inches, brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) when moist; weak, coarse, prismatic structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine roots; many fine and few medium tubular pores; clay as common thin films on sand grains and as bridges between grains; noncalcareous; neutral (pH 7.2); clear, wavy boundary. 8 to 16 inches thick.

B3—22 to 48 inches, reddish-brown (5YR 4/4) light sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; common very fine and fine roots; common fine tubular pores; few scattered sandstone pebbles; noncalcareous; neutral (pH 7.0); abrupt, wavy boundary. 15 to 30 inches thick.

Ab—48 to 54 inches, brown (7.5YR 5/4) light sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; few fine roots; few fine and very fine tubular pores; common, fine, soft masses of lime and lime-filled root channels; calcareous; moderately alkaline (pH 7.9); clear, smooth boundary. 4 to 8 inches thick.

Bb—54 to 67 inches, reddish-brown (5YR 5/4) light sandy clay loam, (5YR 4/4) when moist; weak, coarse, prismatic structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; few fine tubular pores; common, fine and medium, soft masses of lime; calcareous; moderately alkaline (pH 8.2).

Content of organic matter generally averages less than 1 percent to a depth of 10 inches. In the A horizon hue ranges from 10YR through 7.5YR, value is 4 or 5 when dry and 3 or 4 when moist, and chroma is 3 or 4. The A horizon ranges from fine sandy loam to loamy fine sand. In the B horizon value is 4 or 5 when dry and 3 or 4 when moist, and chroma ranges from 4 through 6. The B horizon ranges from heavy sandy loam to sandy clay loam.

Canez loamy fine sand, 0 to 3 percent slopes (Ca).—This soil is nearly level to gently undulating. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is loamy fine sand about 11 inches thick. Included in mapping were small tracts of Redona, Bascom, and Springer soils.

Runoff is very slow on this Canez soil. The hazard of soil blowing is severe.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IVe–8; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Canez loamy fine sand, 1 to 5 percent slopes (CB).—This soil is gently undulating to undulating. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is loamy fine sand about 9 inches thick. Included in mapping were small tracts of Redona, Bascom, and Springer soils.

Runoff is slow on this Canez soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Canez loamy fine sand, 3 to 9 percent slopes (Cc).—This soil is undulating to gently rolling. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but it has a loamy fine sand surface layer about 8 inches thick. Included in mapping were small tracts of Ima, La Lande, and Quay soils.

Runoff is slow to medium on this Canez soil. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

This soil is used for range, as wildlife habitat, for irrigated crops, and for watershed. Irrigated capability unit IVe–13; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Canez loamy fine sand, 0 to 3 percent slopes, hummocky (Cd).—This soil is nearly level to gently undulating. It is on upland alluvial fans in abandoned fields that were formerly used as cropland.

The profile of this soil is similar to that described as representative for the series, but the surface has been altered and, in places, entirely removed by soil blowing.

About 55 percent of this mapping unit consists of low hummocks of accumulated loamy fine sand. The hummocks are 18 to 42 inches thick over a light sandy clay loam subsoil. About 30 percent of the unit consists of areas where the surface layer has been blown away and the sandy clay loam subsoil has been exposed.

Included with this soil in mapping were areas of Ima, Springer, Redona, and Tivoli soils, and of Canez soils, calcareous variant. These included areas make up about 15 percent of the mapped acreage of this soil.

Runoff is slow on this Canez soil. The hazard of further soil blowing is severe. Soil blowing is common in the more barren areas and less common in places where the soil is better stabilized by vegetation.

This soil is used as wildlife habitat and for range. Dryland capability subclass VIIe; Deep Sand range site; wildlife habitat group B.

Canez fine sandy loam, 0 to 3 percent slopes (Ce).—This soil is level to nearly level. It is on upland alluvial fans.

Included with this soil in mapping were small tracts of Redona, Ima, and Bascom soils.

Runoff is slow on this Canez soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe-4; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Canez fine sandy loam, 1 to 5 percent slopes (CF).—This soil is nearly level to gently sloping. It is on alluvial fans below sandstone hills and ridges.

This soil has the profile described as representative for the Canez series. Included in mapping were small areas of Redona and Los Tanos soils.

Runoff is slow to medium on this Canez soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Canez Variant

The Canez variant consists of deep, well-drained, calcareous soils that formed in wind-reworked, mixed sandy alluvium. The soils are on alluvial fans at the margin of the High Plains. Slopes are 0 to 9 percent. The vegetation is mixed mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Bascom, Potter, and Ima soils.

In a representative profile the surface layer is light-brown fine sandy loam about 7 inches thick. The subsoil is light reddish-brown fine sandy loam and loam about 14 inches thick. The substratum to a depth of 60 inches or more is pale-red sandy clay loam that has a high content of lime. The soil is strongly calcareous throughout the profile.

Permeability is moderate in the Canez soils, calcareous variant. Available water holding capacity is 8.5 to 9.5 inches. Effective rooting depth is 60 inches or more.

Most areas of these soils are used for range, as wildlife habitat, and for watershed. Limited acreages are in irrigated crops.

Representative profile of Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes, 600 feet south of the northeast corner of sec. 14, T. 11 N., R. 35 E.:

A1—0 to 7 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak, thick, platy structure and weak, medium, granular; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine and few medium tubular pores; strongly calcareous; mildly alkaline (pH 7.8); gradual, smooth boundary. 5 to 8 inches thick.

B1—7 to 15 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; weak, medium, prismatic structure and weak, fine, subangular blocky; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine and few coarse tubular pores; strongly calcareous; mildly alkaline (pH 7.8); abrupt, smooth boundary. 5 to 8 inches thick.

B2ca—15 to 21 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 5/3) when moist; weak, coarse, prismatic structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; many fine and medium tubular pores; many, fine and medium, distinct threads of lime; strongly calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary. 6 to 20 inches thick.

Cca—21 to 60 inches, pale-red (10R 6/3 sandy clay loam, light reddish brown (2.5YR 6/4) when moist; massive; very hard, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; many medium and few fine tubular pores; strongly calcareous; strongly alkaline (pH 8.6).

In the A horizon hue ranges from 10YR through 5YR, values are 5 or 6 when dry and 4 or 5 when moist, and chromas are 3 or 4. The A horizon ranges from fine sandy loam to loam. In the Cca horizon hue ranges from 10R to 5YR, value from 6 to 8 when dry, and chroma from 1 to 3 when dry. The Cca horizon begins at a depth of 16 to 36 inches.

Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes (Ch).—This soil is level to nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the Canez variant, but the substratum is pinkish-white sandy clay loam that has a high content of lime.

Included with this soil in mapping were areas of Redona, Bascom, and Potter soils, and areas of Canez loam, calcareous variant. These included areas make up about 10 percent of the mapped acreage of this soil.

Runoff is slow on this soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe–4; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes (Cl).—This soil is level to nearly level. It is on upland alluvial fans.

This soil has the profile described as representative for the Canez variant.

Included with this soil in mapping were areas of Bascom, Potter, and Amarillo soils. These included areas make up about 15 percent of the mapped acreage of this soil.

Runoff is slow on this soil. The hazard of soil blowing is moderate.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes (Cn).—This soil is gently sloping to moderately sloping. It is on upland alluvial fans along the margin of the High Plains.

The profile of this soil is similar to that described as representative for the Canez variant, but it has a fine sandy loam surface layer about 5 inches thick.

Included with this soil in mapping were small tracts of Bascom, Redona, and Potter soils, and areas of Canez loam, calcareous variant.

Runoff is medium on this soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVe–13; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Canez loam, calcareous variant, 0 to 3 percent slopes (CV).—This soil is level to nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the Canez variant, but it has a reddish-brown surface layer about 6 inches thick. Included in mapping were small tracts of Bascom, Redona, and Canez soils.

Runoff is medium on this soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Dune Land

Dune land (DU) consists of rolling sand dunes. The dunes range from 6 to 20 feet or more in height (fig. 5). This mapping unit is in association with the Springer, Brownfield, and Tivoli soils, and collectively these are known as the "Sandhill Country." Plants do not grow on the dunes. Sand sagebrush, yucca, mesquite, big and little bluestem, and indiangrass grow along the fringes of the dunes and on the soils included in mapping. Elevation ranges from 4,200 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Included in mapping were small tracts of Tivoli, Springer, and Gomez soils.

Permeability is very rapid in the soils of this land type. Runoff is very slow. The hazard of soil blowing is very severe.

Some areas of Dune land are suitable for recreation and for wildlife habitat. If areas of this land type are to be reclaimed, fences are needed to prevent all grazing until vegetation is reestablished. Reseeding is difficult but necessary to help control erosion. Dryland capability subclass VIIIe; range site not assigned; wildlife habitat group F.

Gallegos Series

The Gallegos series consists of deep, well-drained soils that formed in gravelly sediment on old terrace rem-

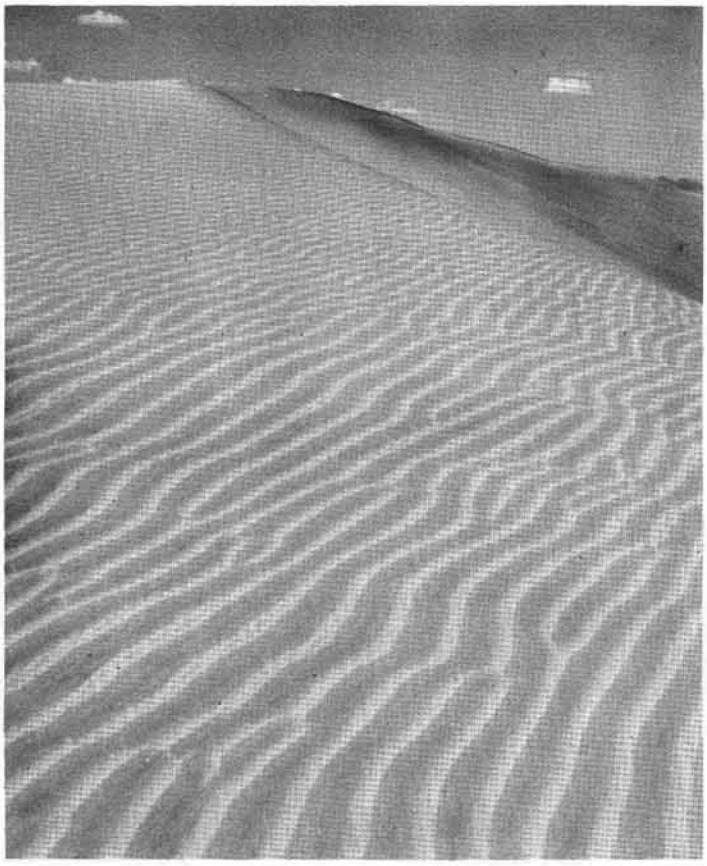

Figure 5.—**View of Dune land in Tucumcari Area.**

nants. Slopes are 1 to 25 percent. The vegetation is mixed mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the La Lande, Bascom, Quay, and Potter series.

In a representative profile the surface layer and the subsoil are brown very gravelly loam. Each is about 6 inches thick. The substratum to a depth of 60 inches or more is pink and pinkish-white very gravelly loam that has a high content of lime.

Permeability is moderately rapid in these soils. Available water holding capacity is 1 to 1.5 inches. Effective rooting depth is 8 to 16 inches.

Gallegos soils are used for range, as wildlife habitat, as a source of commercial gravel, and for watershed.

Representative profile of Gallegos very gravelly loam, 9 to 25 percent slopes, SW¼NE¼NE¼SE¼ sec. 17, T. 15 N., R. 35 E.:

A1—0 to 6 inches, brown (7.5YR 5/3) very gravelly loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure that parts to weak, granular; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine interstitial pores; 40 percent gravel; noncalcareous; neutral (7.2); clear, wavy boundary. 4 to 8 inches thick.

B2—6 to 12 inches, brown (7.5YR 5/2) very gravelly loam, light brown (7.5YR 4/2) when moist; weak, fine, subangular blocky structure that parts to weak, fine, granular; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few coarse tubular pores; 60 percent gravel; strongly calcareous; mildly alkaline (pH 7.8); gradual, smooth boundary. 4 to 8 inches thick.

C1ca—12 to 18 inches, pink (7.5YR 7/4) very gravelly loam, reddish yellow (7.5YR 7/6) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; 65 percent gravel; strongly calcareous; moderately alkaline (pH 8.1); gradual, wavy boundary. 4 to 8 inches thick.

C2ca—18 to 60 inches, pinkish-white (7.5YR 8/2) soft caliche of very gravelly loam texture, light brown (7.5YR 6/4) when moist; massive; hard, firm when moist, slightly sticky and slightly plastic when wet; common fine tubular pores; 70 percent gravel; thick coatings of cemented lime on bottom of gravel, content of lime decreases below depth of 30 inches; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon content of gravel and cobblestones ranges from 35 to 50 percent. In the B and C horizons it ranges from 35 to 80 percent.

In Gallegos gravelly loam, 3 to 9 percent slopes, however, content of gravel is as low as 25 percent. This soil, mapped as a constituent of Gallegos complex, 3 to 9 percent slopes (Gl), contains less gravel than is defined in the range for the Gallegos series, but is of limited acreage. This difference does not alter the usefulness or behavior of the soil.

Gallegos very gravelly loam, 1 to 9 percent slopes (GA).—This soil is gently undulating to gently rolling. It is on old terraces.

The profile of this soil is similar to that described as representative for the series, but it contains 35 to 50 percent gravel throughout. These pebbles are smaller than those in the representative profile, and they average about 1 inch in diameter.

Included with this soil in mapping were small tracts of Ima, Quay, and Bascom soils. Also included were areas of soils similar to the Gallegos soils, except that they are calcareous throughout.

Runoff is medium to rapid on this Gallegos soil. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. It is also used as a source of commercial gravel. Dryland capability subclass VIe; Shallow range site; wildlife habitat group C.

Gallegos very gravelly loam, 9 to 25 percent slopes (Gg).—This soil is rolling to hilly. It is on old gravelly terraces.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of La Lande soils and areas of Bascom variant.

Runoff is rapid on this Gallegos soil. The hazard of water erosion is moderate to severe.

This soil is used for range, as wildlife habitat, and for watershed. It is also used as a source of gravel for construction. Dryland capability subclass VIe; Shallow range site; wildlife habitat group C.

Gallegos very gravelly loam, 9 to 25 percent slopes (GH).—This soil is rolling to hilly. It is on old gravelly terraces, mostly along the Canadian River.

This soil has the profile described as representative for the Gallegos series.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Quay, Ima, Bascom, and Latom soils.

Runoff is rapid on this soil. The hazard of water erosion is moderate to severe.

This soil is used for range, as wildlife habitat, and for watershed. It is also used as a source of gravel for construction. Dryland capability subclass VIe; Shallow range site; wildlife habitat group C.

Gallegos complex, 3 to 9 percent slopes (Gl).—Gallegos very gravelly loam makes up about 45 percent of this complex, and Gallegos gravelly loam makes up about 40 percent. Included soils make up the other 15 percent. Gallegos very gravelly loam is gently rolling, and Gallegos gravelly loam is undulating to gently rolling. Both soils are on gravelly terraces.

Gallegos gravelly loam has a profile similar to that described as representative for the Gallegos series, but the soil is calcareous throughout and contains 25 to 35 percent gravel.

Included with these soils in mapping, and making up about 10 percent of the mapped acreage, were areas of Gallegos very gravelly loam, 9 to 25 percent slopes. Also included, and making up about 5 percent of the mapped acreage of these soils, were areas of Quay, La Lande, and San Jon soils.

Runoff is medium to rapid on the soils of this complex. The hazard of water erosion is moderate.

These soils are used for range, as wildlife habitat, and for watershed. They are also used as a source of commercial gravel. Dryland capability subclass VIe; Shallow range site; wildlife habitat group C.

Gomez Series

The Gomez series consists of deep, well-drained soils that formed in mixed sandy alluvium reworked by wind action. They are on uplands. Slopes are 0 to 3 percent. The vegetation is mid and tall grasses, sand sagebrush, yucca, and mesquite. Elevation ranges from 3,800 to 4,600 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Tivoli, Springer, and Amarillo series.

In a representative profile the surface layer is light-brown loamy fine sand about 11 inches thick. The subsoil is brown and pale-brown light sandy loam about 14 inches thick. The substratum, to a depth of about 34 inches, is light-gray sandy loam that has a high content of lime. Below this, to a depth of 60 inches or more, is white silt loam that also has a high content of lime.

Permeability is moderately rapid in the Gomez soils. Available water holding capacity is 3.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches.

These soils are used for range, as wildlife habitat, and for irrigated crops.

Representative profile of Gomez loamy fine sand, 0 to 3 percent slopes, SE¼NW¼NE¼ sec. 15, T. 14 N., R. 34 E.:

A1—0 to 11 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; very few fine interstitial pores; noncalcareous; neutral (pH 7.0); clear, smooth boundary. 10 to 16 inches thick.

B21—11 to 21 inches, brown (7.5YR 5/4) light sandy loam, dark brown (7.5YR 4/4) when moist; very weak, medium, prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; few fine tubular pores; noncalcareous; mildly alkaline (pH 7.4); gradual, wavy boundary. 10 to 18 inches thick.

B22—21 to 25 inches, pale-brown (10YR 6/3) light sandy loam, dark brown (10YR 4/3) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; many fine tubular pores; slightly calcareous; mildly alkaline (pH 7.6); clear, wavy boundary. 0 to 6 inches thick.

C1ca—25 to 34 inches, light-gray (10YR 7/1) sandy loam, gray (10YR 6/1) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; strongly calcareous; moderately alkaline (pH 7.9); abrupt, smooth boundary. 5 to 35 inches thick.

IIC2ca—34 to 60 inches, white (10YR 8/2) silt loam, light gray (10YR 7/2) when moist; massive; hard, friable when moist, slightly sticky and plastic when wet; few fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2).

In the A horizon hue ranges from 7.5YR to 10YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma ranges from 2 through 4. The Cca horizon begins at a depth of 20 to 40 inches. The C1ca horizon extends to a depth of 60 inches or more in places. The IIC2a horizon is discontinuous.

Gomez loamy fine sand, 0 to 3 percent slopes (Gm).—This soil is nearly level to gently undulating. It is on concave uplands.

The profile of this soil is similar to that described as representative for the series, but all of the substratum is sandy loam.

Included with this soil in mapping were areas of Quay, Bascom, and Ima soils. These included areas make up about 10 percent of the mapped acreage of this soil.

Runoff is very slow on this Gomez soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. A limited acreage is in irrigated cropland. Irrigated capability unit IVe-8; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Gomez loamy fine sand, 0 to 3 percent slopes (GN).—This soil is nearly level to gently undulating. It is on concave uplands.

This soil has the profile described as representative for the Gomez series.

Included with this soil in mapping were areas of Tivoli, Springer, and Bascom soils. These included areas make up about 15 percent of the mapped acreage of this soil.

Runoff is very slow on this soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Gullied Land, San Jon Material

Gullied land, San Jon material (1 to 5 percent slopes) (GU) consists of San Jon soils that have been converted into a network of gullies by water erosion. Gullies 10 to 15 feet deep that have tributary gullies 2 to 5 feet deep are common. This land type is on erosional remnants of red-bed shale and interbedded sandstone. It is nearly bare of vegetation, except for forbs and scattered mesquite, yucca, and short grasses. Elevation ranges from

3,800 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Included in mapping, and making up about 10 percent of the mapped acreage of this land type, were areas of Montoya, Lacita, and Quay soils.

On areas of this land type the surface layer and much of the material in the subsoil have been removed by sheet and gully erosion, and the unconsolidated shale in the substratum is exposed. A mantle of waterworn gravel covers 20 to 65 percent of the surface.

Permeability is slow in the soils of this land type. Runoff is rapid. The hazard of water erosion is very severe.

Most areas of Gullied Land, San Jon material, are idle, but a few areas are used as wildlife habitat and for watershed. If these areas are to be reclaimed, fences are needed to prevent all grazing until vegetation is reestablished. Water spreading and the construction of dams for erosion control help to stabilize the gullies. Dryland capability subclass VIIIe; range site not assigned; wildlife habitat group F.

Ima Series

The Ima series consists of deep, well-drained soils that formed in mixed sandy sediment derived largely from red-bed formations. They are on alluvial fans and piedmont slopes. Slopes are 1 to 5 percent. The vegetation is mixed mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,600 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Los Tanos, Montoya, and Quay series.

In a representative profile the surface layer is reddish-brown sandy loam and fine sandy loam about 10 inches thick. The subsoil is light reddish-brown fine sandy loam about 30 inches thick. The substratum to a depth of 60 inches or more is reddish-yellow very fine sandy loam.

Permeability is moderately rapid in the Ima soils. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is 60 inches or more.

Ima soils are used for range, as wildlife habitat, and for watershed. A small acreage is in irrigated crops.

Representative profile of Ima sandy loam, 3 to 5 percent slopes, 1,000 feet west and 120 feet south of the northeast corner of sec. 10, T. 11 N., R. 30 E.:

A11—0 to 5 inches, reddish-brown (5YR 5/3) sandy loam, (5YR 4/3) when moist; weak, thin and medium, platy structure in upper 2 inches and weak, fine, granular below; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; few fine interstitial pores; noncalcareous; mildly alkaline (pH 7.5); clear, smooth boundary. 2 to 6 inches thick.

A12—5 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, (5YR 4/3) when moist; very weak, fine, subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine tubular pores; noncalcareous; mildly alkaline (pH 7.5); clear, smooth boundary. 4 to 8 inches thick.

B21—10 to 32 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, prismatic structure and weak, medium, subangular blocky; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few medium and common fine tubular pores; few fine streaks of lime in lower part; calcareous; mildly alkaline (pH 7.8); clear, smooth boundary. 10 to 24 inches thick.

B22ca—32 to 40 inches, light reddish-brown (5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common fine tubular pores; common, fine and medium, soft, white nodules of lime; calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary. 4 to 10 inches thick.

C—40 to 60 inches, reddish-yellow (5YR 7/6) very fine sandy loam, yellowish red (5YR 5/6) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few fine tubular pores; calcareous; moderately alkaline (pH 7.9).

Calcium carbonate ($CaCO_3$) equivalent to a depth of 40 inches ranges from 0 to 15 percent.

In the A horizon hue ranges from 5YR through 10YR, and value is 5 or 6 when dry and 4 or 5 when moist. The A horizon ranges from calcareous to noncalcareous and from mildly alkaline to moderately alkaline. In the B horizon hue ranges from 2.5YR through 7.5YR, value from 5 through 7 when dry and from 4 through 6 when moist, and chroma from 3 through 5. The B horizon ranges from sandy loam to loam and is less than 18 percent clay. In the B horizon gravel content ranges from 0 to 15 percent. The B horizon ranges from calcareous to noncalcareous and from mildly alkaline to moderately alkaline. In the lower part of the B horizon and in the C horizon segregated lime ranges from few fine streaks to common soft masses. In the C horizon hue ranges from 2.5YR to 5YR, value from 5 through 7 when dry, and chroma from 4 through 6. Buried horizons are present in places below a depth of 40 inches.

Ima sandy loam, 1 to 3 percent slopes (Im).—This soil is gently undulating. It is on upland alluvial fans and on areas of piedmont slopes.

The profile of this soil is similar to that described as representative for the series, but it is reddish brown and calcareous throughout. Included in mapping were small areas of La Lande, Quay, and Canez soils.

Runoff is slow on this Ima soil. The hazard of soil blowing is moderate to severe.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe-4; dryland capability subclass VIe; Sandy range site; wildlife habitat group B.

Ima sandy loam, 1 to 5 percent slopes (IN).—This soil is gently undulating to undulating. It is on upland alluvial fans and on areas of piedmont slopes.

The profile of this soil is similar to that described as representative for the series, but the subsoil is sandy loam.

Included with this soil in mapping were areas of Los Tanos, La Lande, Quay, Redona, and Springer soils, and of Ima sandy loam, eroded.

Runoff is slow to medium on this soil. The hazard of soil blowing is moderate to severe. The hazard of water erosion is slight to moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Sandy range site; wildlife habitat group B.

Ima sandy loam, 3 to 5 percent slopes (Is).—This soil

is undulating. It is on upland alluvial fans and on areas of piedmont slopes.

This soil has the profile described as representative for the Ima series. Included in mapping were small tracts of La Lande, Quay, and Canez soils.

Runoff is medium on this Ima soil. The hazard of soil blowing is moderate to severe, and the hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVe–13; dryland capability subclass VIe; Sandy range site; wildlife habitat group B.

Kinkead Series

The Kinkead series consists of deep, well-drained soils that formed in mixed medium-textured and fine-textured alluvium on concave alluvial fans. Slopes are 0 to 3 percent. The vegetation is mid and short grasses and, in places, shrubs and forbs. Elevation ranges from 4,000 to 4,500 feet. The average annual preciptation is 14 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 175 to 195 days. Associated soils are in the Tucumcari and Montoya series.

In a representative profile the surface layer is brown clay loam about 7 inches thick. The subsoil is brown heavy silty clay loam and reddish-gray clay about 18 inches thick. The substratum is light reddish-brown heavy clay loam to a depth of 60 inches or more. The soil is noncalcareous in the upper 19 inches.

Permeability is slow in these soils. Available water holding capacity is 11 to 12 inches. Effective rooting depth is 60 inches or more.

The Kinkead soils are used for range, as wildlife habitat, for watershed, and to a limited extent for irrigated crops.

Representative profile of Kinkead clay loam, 0 to 3 percent slopes, three-tenths mile south of the northeast corner of sec. 33, T. 10 N., R. 34 E:

A1—0 to 7 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; moderate, coarse, granular structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many fine roots; many fine vesicular pores; noncalcareous; neutral (pH 7.0); clear, wavy boundary. 6 to 8 inches thick.

B2t—7 to 19 inches, brown (7.5YR 5/4) heavy silty clay loam, dark brown (7.5YR 3/2) when moist; strong, medium, subangular blocky structure; very hard, very firm when moist, very sticky and very plastic when wet; many fine roots in upper part, common fine roots in lower part; most roots follow horizon cleavage planes; few fine tubular pores; thin, continuous clay films on vertical ped surfaces; noncalcareous; neutral (pH 7.2); clear, wavy boundary. 12 to 24 inches thick.

B3ca—19 to 25 inches, reddish-gray (5YR 5/2) clay, reddish brown (5YR 4/4) when moist; weak, moderate, prismatic structure; hard, firm when moist, very sticky and very plastic when wet; few fine roots; few fine tubular pores; fine prominent threads of lime; strongly calcareous; moderately alkaline (pH 8.0); diffuse, smooth boundary. 6 to 18 inches thick.

Cca—25 to 60 inches, light reddish-brown (5YR 6/4) heavy clay loam, yellowish red (5YR 5/6) when moist; massive; hard, firm when moist, very sticky and very plastic when wet; few fine roots; many fine and common medium tubular pores; few, fine, prominent mycelia and nodules of lime; strongly calcareous; moderately alkaline (pH 8.2).

In the A horizon hue is 7.5YR or 10YR, value is 4 or 5 when dry and 2 or 3 when moist, and chroma is 2 or 3. The A horizon ranges from heavy loam to clay loam or silty clay loam. In the B2t horizon hue is 7.5YR or 10YR, and value is 4 or 5 when dry and 3 or 4 when moist. The B2t horizon is heavy silty clay loam, heavy clay loam, or clay. In the B3ca horizon hue ranges from 5YR to 7.5YR, and value is 5 or 6 when dry.

Kinkead clay loam, 0 to 3 percent slopes (Kl).—This soil is level to nearly level. It is on upland alluvial fans.

This soil has the profile described as representative for the Kinkead series. Included in mapping were areas of Toyah and Tucumcari soils.

Runoff is medium on this Kinkead soil. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Kinkead clay loam, 0 to 1 percent slopes (Km).—This soil is level. It is on concave upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is dark brown, and the subsoil is brown clay about 28 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Tucumcari, Toyah, and Montoya soils.

Runoff is medium on this Kinkead soil. The hazard of water erosion is slight.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIs–1; dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Kinkead clay loam, 1 to 3 percent slopes (Kn).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is dark brown and about 6 inches thick, and the subsoil is brown clay about 24 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Tucumcari, Toyah, La Lande, and Montoya soils.

Runoff is medium on this Kinkead soil. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IIIe–12; dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Lacita Series

The Lacita series consists of deep, well-drained soils that formed in stratified alluvium derived principally from red-bed material. They are on alluvial fans and piedmont slopes. Slopes are 0 to 3 percent. The vegetation is mixed mid and short grasses, shrubs, and forbs. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Tucumcari and Montoya series.

In a representative profile the surface layer is light reddish-brown silt loam about 8 inches thick. The underlying layer is reddish-yellow silt loam about 16 inches

thick. The substratum is light reddish-brown, reddish-brown, and pink heavy silt loam to silty clay loam to a depth of 72 inches or more.

Permeability is moderately slow in the Lacita soils. Available water holding capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

Lacita soils are used for range, as wildlife habitat, and for watershed. A limited acreage is in irrigated crops.

Representative profile of Lacita silt loam, 0 to 3 percent slopes, NE¼SE¼SW¼ sec. 16, T. 8 N., R. 28 E.:

A1—0 to 8 inches, light reddish-brown (5YR 6/4) silt loam, yellowish red (5YR 5/6) when moist; moderate, thin, platy structure in upper 1 to 2 inches that grades to moderate, fine and very fine, granular and subangular blocky; soft, very friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; few very fine and fine tubular pores; disseminated lime; calcareous; moderately alkaline (pH 7.9); clear, smooth boundary. 6 to 12 inches thick.

AC—8 to 24 inches, reddish-yellow (5YR 6/6) silt loam, yellowish red (5YR 5/6) when moist; very weak, coarse, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; many very fine and fine tubular pores; disseminated lime; calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 12 to 24 inches thick.

C1—24 to 36 inches, light reddish-brown (5YR 6/4) heavy silt loam, reddish brown (5YR 5/4) when moist; very weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; common fine vesicular pores; slight evidence of stratification in lower few inches; disseminated lime; calcareous; moderately alkaline (pH 8.4); clear, smooth boundary. 10 to 20 inches thick.

C2—36 to 48 inches, reddish-brown (5YR 5/4) light silty clay loam, (2.5YR 4/4) when moist; very weak, medium, subangular blocky structure; slightly hard, firm when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine and very fine vesicular and few fine tubular pores; few thin strata of silt loam and fine sandy loam less than 1 inch in thickness; disseminated lime; calcareous; moderately alkaline (pH 8.4); gradual, smooth boundary. 8 to 16 inches thick.

C3—48 to 72 inches, pink (5YR 7/4) silty clay loam, reddish brown (5YR 5/4) when moist; massive; slightly hard, firm when moist, slightly sticky and slightly plastic when wet; few very fine roots; few fine and very fine vesicular pores; disseminated lime; calcareous; moderately alkaline (pH 8.4).

In the A and AC horizons, hue ranges from 25YR through 7.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 4 through 6. In the A horizon content of organic matter ranges from 0.5 to 1 percent. In the AC horizon structure ranges from weak, medium and coarse, prismatic to very weak and weak, medium and coarse, subangular blocky. The AC and C horizons range from silt loam and light silty clay loam to loam and light clay loam in which less than 15 percent of the soil material is sand coarser than very fine. In the C horizon hue ranges from 2.5YR through 7.5YR, value from 5 through 7 when dry and from 4 through 6 when moist, and chroma from 4 through 6 when moist. In the C horizon structure ranges from weak, medium, subangular blocky to structureless (massive). Thin strata of sand are present in places below a depth of 30 inches.

Lacita silt loam, 0 to 1 percent slopes (La).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but it is reddish brown throughout.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Tucumcari and Montoya soils.

Runoff is medium on this Lacita soil. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IIe–7; dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Lacita silt loam, 0 to 3 percent slopes (LC).—This soil is level to nearly level. It is on upland alluvial fans and piedmont slopes.

This soil has the profile described as representative for the Lacita series. Included in mapping were areas of Montoya, Quay, and Tucumcari soils.

Runoff is medium on this Lacita soil. The hazards of water erosion and soil blowing are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Lacita silt loam, 1 to 3 percent slopes (Ld).—This soil is nearly level. It is on upland alluvial fans and piedmont slopes.

The profile of this soil is similar to that described as representative for the series, but it is reddish brown throughout.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Tucumcari and Montoya soils.

Runoff is medium on this Lacita soil. The hazard of erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IIIe–12; dryland capability subclass VIe; Loamy range site; wildlife habitat group D.

Lacita silt loam and Gullied land (0 to 3 percent slopes) (LE).—Lacita silt loam makes up about 45 percent of this undifferentiated group, and Gullied land makes up about 40 percent. Included soils make up the other 15 percent. Lacita silt loam is level to nearly level and is on alluvial fans. Gullied land consists of a network of gullies 5 to 30 feet deep that have tributary gullies 2 to 5 feet deep. This land is nearly bare of vegetation (fig. 6).

The Lacita soil has a profile similar to that described as representative for the Lacita series, but part of the surface layer has been removed by rill erosion.

Included with this group in mapping were areas of Gallegos gravelly loam and Ima sandy loam. Each of these inclusions makes up about 5 percent of the mapped acreage of this undifferentiated group. Also included, and making up about 5 percent of the mapped acreage of this group, were areas of Quay, Montoya, and Tucumcari soils.

Runoff is rapid on the soils of this group. The hazard of water erosion is severe.

The soils of this undifferentiated group are used for range, as wildlife habitat, and for watershed. Lacita silt loam in dryland capability subclass VIe, Loamy range site, wildlife habitat Group D; Gullied land in dryland capability subclass VIIIe, range site not assigned, wildlife habitat group F.

Figure 6.—Typical landscape of Lacita silt loam and Gullied land.

La Lande Series

The La Lande series consists of deep, well-drained soils that formed in mixed alluvium on alluvial fans and piedmont slopes. Slopes are 0 to 5 percent. The vegetation is mostly mid grasses, yucca, and mesquite. Elevation ranges from 4,000 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Bascom and Quay series.

In a representative profile the surface layer is brown and light-brown loam about 12 inches thick. The subsoil is light-brown clay loam about 10 inches thick. The substratum is light-brown clay loam that grades to pink fine sandy loam at a depth of about 42 inches. The soil is strongly calcareous and moderately alkaline throughout the profile.

Permeability is moderate in the La Lande soils. Available water holding capacity is 10 to 11 inches. Effective rooting depth is 60 inches or more.

La Lande soils are used for range, as wildlife habitat, for irrigated crops, and for watershed. These soils are dry too much of the time to be suitable for dryfarmed crops.

Representative profile of La Lande loam, 0 to 5 percent slopes, about two-fifths mile south and 400 feet east of the northwest corner of sec. 17, T. 9 N., R. 33 E.:

A11—0 to 5 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; weak, thin, platy structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine vesicular pores; strongly calcareous; moderately alkaline (pH 8.0); gradual, smooth boundary. 4 to 10 inches thick.

A12—5 to 12 inches, light-brown (7.5YR 6/4) loam, slightly heavier than in A11; brown (7.5YR 5/4) when moist; weak, medium, prismatic structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine vesicular pores; strongly calcareous; moderately alkaline (pH 8.2); gradual, smooth boundary. 6 to 14 inches thick.

B2—12 to 22 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist, weak, medium, prismatic structure and moderate, medium, subangular blocky; very hard, firm when moist, sticky and plastic when wet; common fine roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 10 to 16 inches thick.

C1ca—22 to 42 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; weak, medium, prismatic structure and weak, medium, subangular blocky; very hard, firm when moist, sticky and plas-

tic when wet; few fine roots; common fine tubular pores; common, fine, soft nodules of lime; strongly calcareous; moderately alkaline (pH 8.4); gradual, smooth boundary. 10 to 20 inches thick.

IIC2—42 to 60 inches, pink (7.5YR 7/4) fine sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic when wet; few very fine roots; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline (pH 8.4).

In the A horizon hue ranges from 2.5YR through 7.5YR, value is 5 or 6 when dry, and chroma is 4 or 5. The A horizon ranges from loam to fine sandy loam. In the B horizon hue ranges from 2.5YR through 7.5YR, value from 5 through 7 when dry and from 3 through 5 when moist, and chroma from 4 through 6. In the B horizon structure ranges from weak, coarse, prismatic to weak and moderate, fine to medium, subangular blocky. The B and C1ca horizons are loam, sandy clay loam, or clay loam in which 18 to 35 percent of the soil material is clay and less than 15 percent is coarse fragments. In these horizons calcium carbonate is disseminated or occurs in common, fine and medium, soft masses or nodules.

La Lande fine sandy loam, 0 to 1 percent slopes (Ll).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown fine sandy loam about 8 inches thick. Included in mapping were a few small areas of Redona, Quay, and Ima soils.

Runoff is slow on this La Lande soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIe–3; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

La Lande fine sandy loam, 1 to 3 percent slopes (Lm).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown fine sandy loam about 6 inches thick. Included in mapping were a few small areas of Quay, Redona, and Ima soils.

Runoff is slow on this La Lande soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe–4; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

La Lande fine sandy loam, 1 to 5 percent slopes (LN).—This soil is nearly level to gently sloping. It is on upland alluvial fans and piedmont slopes.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown fine sandy loam about 10 inches thick.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Ima, Quay, and Bascom soils.

Runoff is slow to medium on this La Lande soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

La Lande loam, 0 to 1 percent slopes (Lo).—This soil is level. It is on valley-filling alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam about 8 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Redona loam and Tucumcari loam.

Runoff is medium on this La Lande soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe–1; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

La Lande loam, 1 to 3 percent slopes (Lp).—This soil is nearly level. It is on valley-filling alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam about 6 inches thick. Included in mapping were a few small areas of Redona and Quay soils.

Runoff is medium on this La Lande soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe–8; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

La Lande loam, 0 to 5 percent slopes (LR).—This soil is level to gently sloping. It is on valley-filling alluvial fans.

This soil has the profile described as representative for the La Lande series. Included in mapping were areas of Ima, Los Tanos, Quay, and Bascom soils.

Runoff is medium to rapid on this La Lande soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

La Lande loam, 3 to 5 percent slopes (Ls).—This soil is gently sloping. It is on valley-filling alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam about 6 inches thick. Included in mapping were a few small areas of Quay, Canez, and Redona soils.

Runoff is medium on this La Lande soil. The hazards of soil blowing and water erosion are moderate to severe. In irrigated areas part of the surface layer of this soil has been removed by water erosion.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVe–13; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Latom Series

The Latom series consists of well-drained soils that are very shallow to shallow over sandstone bedrock. They formed in material weathered from sandstone on upland ridges. Slopes are 3 to 50 percent. The vegetation is mid grasses, shrubs, and forbs. Elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 58° F. The frost-free season is 180 to 195 days. Associated soils are in the Los Tanos, Ima, and Canez series.

In a representative profile the surface layer is light reddish-brown stony sandy loam about 5 inches thick.

The substratum is reddish-brown and light reddish-brown sandy loam about 7 inches thick. Sandstone bedrock is at a depth of about 12 inches. The soil is noncalcareous and moderately alkaline.

Permeability is moderate in the Latom soils. Available water holding capacity is 1 to 2 inches. Effective rooting depth is 6 to 20 inches.

The Latom soils are used for range, as wildlife habitat, and for watershed.

Representative profile of Latom stony sandy loam, 3 to 9 percent slopes, one-tenth mile west and 200 feet south of private farm road and just off old U.S. Highway 66, SW¼NW¼ sec. 9, T. 10 N., R. 29 E.:

A1—0 to 5 inches, light reddish-brown (5YR 6/4) stony sandy loam, reddish brown (2.5YR 5/4) when moist; weak, thick, platy structure and weak, fine, granular; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; very few fine tubular pores; noncalcareous; moderately alkaline (pH 8.4); clear, smooth boundary. 3 to 8 inches thick.

C1—5 to 8 inches, reddish-brown (5YR 5/4) sandy loam, (5YR 4/4) when moist; very weak, medium, prismatic structure and very weak, fine, subangular blocky; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; very few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); abrupt, wavy boundary. 3 to 6 inches thick.

C2—8 to 12 inches, light reddish-brown (5YR 6/4) weathered sandstone rock in sandy loam soil matrix, reddish brown (5YR 5/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; few coarse tubular pores; noncalcareous; moderately alkaline (pH 8.3); abrupt, wavy boundary. 0 to 6 inches thick.

R—12 inches, light reddish-brown (5YR 6/4) sandstone; thin, discontinuous coatings of calcium carbonate ($CaCO_3$) in crevices.

The soil material is 15 to 35 percent sandstone fragments ranging in size from pebbles to stones throughout the profile. The soil ranges from noncalcareous to calcareous. In the A horizon hue is 7.5YR to 2.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. The A horizon ranges from stony sandy loam to stony loam. Sandstone bedrock begins at a depth that ranges from 6 to 20 inches and averages about 10 inches.

Latom stony loam, 3 to 9 percent slopes (Lt).—This soil is gently sloping to moderately sloping. It is on upland ridges.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown stony loam about 6 inches thick.

Included with this soil in mapping were areas of scattered rock outcroppings, Latom stony sandy loam, 9 to 25 percent slopes, and Los Tanos soils.

Runoff is medium on this Latom soil. The hazard of water erosion is moderate. Scattered stones are 5 to 30 feet apart.

This soil is used for range and watershed, and as wildlife habitat. Dryland capability subclass VIIs; Shallow Sandstone range site; wildlife habitat group C.

Latom stony sandy loam, 3 to 9 percent slopes (LU).—This soil is gently sloping to moderately sloping. It is on upland sandstone ridges.

This soil has the profile described as representative for the Latom series.

Included with this soil in mapping were areas of scattered rock outcroppings and of Los Tanos, Canez, and Ima soils.

Runoff is medium on this Latom soil. The hazards of soil blowing and water erosion are moderate. Scattered stones are 5 to 30 feet apart.

This soil is used for range and watershed, and as wildlife habitat. Dryland capability subclass VIIs; Shallow Sandstone range site; wildlife habitat group C.

Latom-Rock outcrop complex, hilly (9 to 25 percent slopes) (LV).—Latom stony sandy loam makes up about 55 percent of this complex, and Rock outcrop makes up about 20 percent (fig. 7). Included soils make up the other 25 percent. The Latom soil is on ridgetops and side slopes and is rolling to hilly. The areas of Rock outcrop are on narrow sandstone escarpments and scattered bedrock exposures.

Included with this complex in mapping, and making up about 10 percent of the mapped acreage, were areas of Los Tanos sandy loam. These areas are on ridgetops. Also included, and making up about 15 percent of the mapped acreage of this complex, were areas of Ima, Canez, and San Jose soils. These areas are on fans below the escarpments.

Runoff is rapid on the soils of this complex. The hazard of water erosion is moderate to severe.

The soils of this complex are used for range and watershed, and as wildlife habitat. Dryland capability subclass VIIs; Shallow Sandstone range site; wildlife habitat group E.

Latom-Rock outcrop complex, steep (25 to 50 percent slopes) (LW).—Latom stony sandy loam makes up about 50 percent of this complex, and Rock outcrop makes up about 25 percent. Included soils make up the other 25 percent. The Latom soil is on narrow ridgetops and side slopes and is steep. The areas of Rock outcrop are on narrow sandstone escarpments and scattered bedrock exposures.

Included with this complex in mapping, and making up about 10 percent of the mapped acreage, were areas of Los Tanos sandy loam. These areas are on side slopes. Also included, and making up about 10 percent of the mapped acreage of this complex, were areas of Canez, Ima, and San Jose soils. These areas are on fans below the escarpments. Also included, and making up about 5 percent of the mapped acreage, were areas of Potter and Sharvana soils. These areas are on the tops of ridges and mesas.

Runoff is rapid on the soils of this complex. The hazard of water erosion is severe.

The soils of this complex are used for range and watershed, and as wildlife habitat. Dryland capability subclass VIIs; Breaks range site; wildlife habitat group E.

Los Tanos Series

The Los Tanos series consists of well-drained soils that are moderately deep over sandstone bedrock. They formed in material weathered from sandstone and are on low hills, ridges, and mesas. Slopes are 1 to 5 percent. The vegetation is principally mid grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the

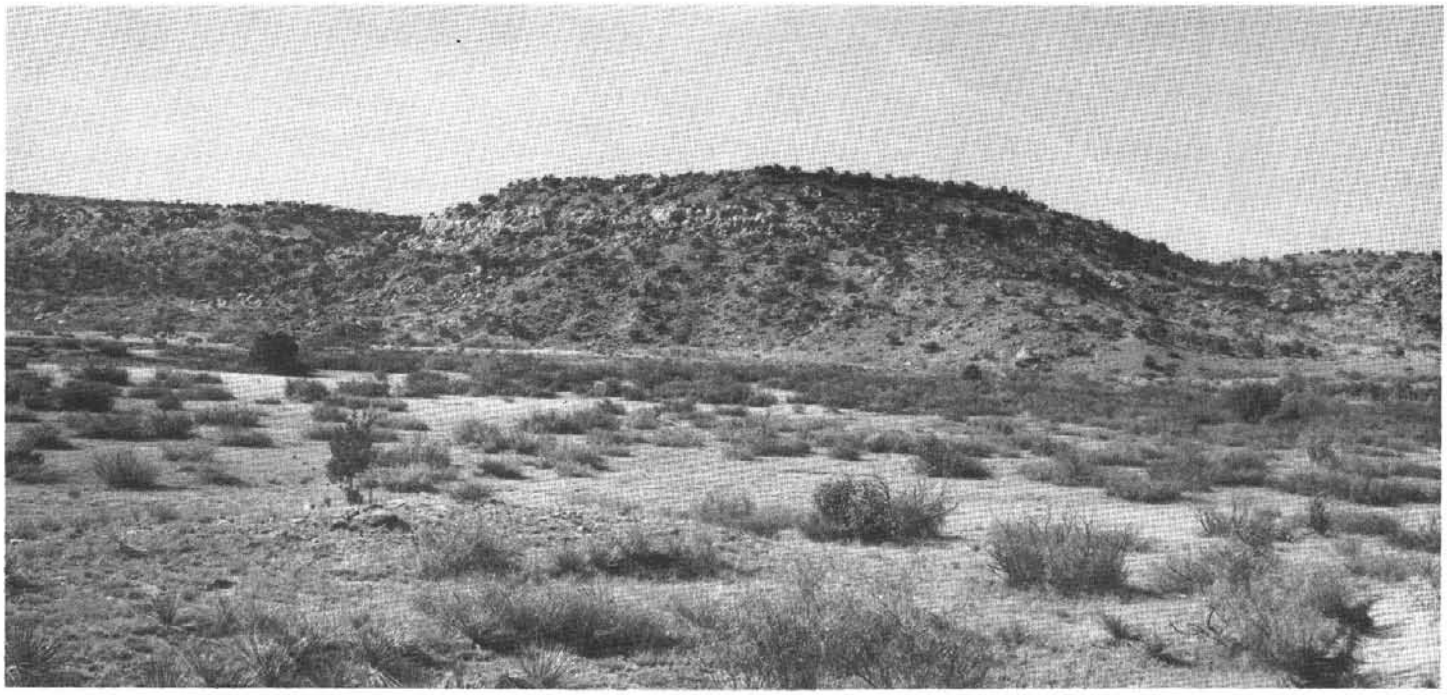

Figure 7.—View of Latom-Rock outcrop complex, hilly.

average annual air temperature is 57° to 60° F. The frost-free season is 180 and 195 days. Associated soils are in the Latom, La Lande, and Ima series.

In a representative profile the surface layer is light-brown sandy loam about 6 inches thick. The subsoil is reddish-brown sandy loam about 18 inches thick. The substratum is reddish-yellow, partly weathered sandstone. Unweathered sandstone is at a depth of 30 inches. The soil is mildly alkaline.

Permeability is moderately rapid in the Los Tanos soils. Available water holding capacity is 2.5 to 3.5 inches. Effective rooting depth is 20 to 40 inches.

These soils are used for range, as wildlife habitat, and for watershed. A limited acreage is in irrigated crops.

Representative profile of Los Tanos sandy loam, 1 to 5 percent slopes, three-fifths mile east and one-tenth mile south of the slopes northwest corner of sec. 36, T. 11 N., R. 35 E.:

A1—0 to 6 inches, light-brown (7.5YR 6/3) sandy loam, brown (7.5YR 4/3) when moist; weak, thick, platy structure in upper 1 inch and weak, fine, granular below; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; noncalcareous; mildly alkaline (pH 7.4); clear, smooth boundary. 4 to 8 inches thick.

B2—6 to 24 inches, reddish-brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium, prismatic structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine and medium tubular pores; lime as few very thin coatings in root channels, as threads in lower part; calcareous; mildly alkaline (pH 7.5); abrupt, smooth boundary. 16 to 22 inches thick.

C—24 to 30 inches, reddish-yellow (5YR 6/6) partly weathered sandstone, yellowish red (5YR 4/6) when moist; few fractures in upper part; calcareous; clear, smooth boundary. 0 to 10 inches thick.

R—30 inches, unweathered indurated sandstone.

In the solum reaction ranges from mildly to moderately alkaline. In the A horizon hue ranges from 5YR to 10YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma is 2 or 3. In the B horizon hue ranges from 2.5YR to 7.5YR, and value from 4 through 6 when dry and from 3 through 5 when moist. Chroma is 3 or 4. The B horizon ranges from sandy loam to loam in which less than 18 percent of the soil material is clay. In the B horizon structure ranges from prismatic to subangular blocky. In deeper profiles secondary lime accumulation ranges from weak indistinct to distinct in places where a Cca horizon occurs immediately above bedrock, but calcium carbonate equivalent never exceeds 15 percent. Bedrock begins at a depth of 20 to 40 inches.

Los Tanos sandy loam, 1 to 5 percent slopes (lx).—This soil is nearly level to gently sloping. It is on low hills and ridges of uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown sandy loam about 6 inches thick. Included in mapping were a few small areas of Ima, La Lande, and Redona soils.

Runoff is slow to medium on this Los Tanos soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. A limited acreage is in irrigated crops. Irrigated capability unit IVe–1; dryland capability subclass VIe; Sandy range site; wildlife habitat group B.

Los Tanos sandy loam, 1 to 5 percent slopes (lY).—This soil is nearly level to gently sloping. It is on low hills, ridges, and mesas.

This soil has the profile described as representative for the Los Tanos series. Included in mapping were small areas of Ima, Latom, and La Lande soils.

Runoff is slow to medium on this Los Tanos soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Sandy range site; wildlife habitat group B.

Minneosa Series

The Minneosa series consists of deep, somewhat excessively drained soils that formed in sandy alluvium. They are on low terraces and flood plains. Slopes are 0 to 3 percent. The vegetation is sand sagebrush, forbs, and some mid and tall grasses. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Lacita, San Jose, and Ima series.

In a representative profile the surface layer is light-brown loamy fine sand about 10 inches thick. The underlying layer is very pale brown loamy sand about 34 inches thick that has thin strata of sandy loam and fine sandy loam. The substratum is reddish-brown silt loam to a depth of 60 inches or more. The soil is calcareous throughout the profile.

Permeability is moderately rapid in the Minneosa soils. Available water holding capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and as wildlife habitat.

Representative profile of Minneosa loamy fine sand, 1,000 feet west and 100 feet south of the northeast corner of sec. 1, T. 9 N., R. 34 E.:

A1—0 to 10 inches, light-brown (7.5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; few very fine to medium roots; many very fine interstitial pores; disseminated lime; calcareous; mildly alkaline (pH 7.4); clear, wavy boundary. 8 to 16 inches thick.

C1—10 to 44 inches, very pale brown (10YR 7/4) loamy sand, brown (7.5YR 5/4) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; few very fine and fine roots; many fine interstitial pores; strata of sandy loam and fine sandy loam ½ to 2 inches thick irregularly spaced throughout horizon, commonly slightly darker than intervening material; disseminated lime; calcareous; mildly alkaline (pH 7.4); abrupt, smooth boundary. 30 to 48 or more inches thick.

IIC2—44 to 60 inches, reddish-brown (5YR 5/3) silt loam, (5YR 4/3) when moist; massive; weak evidence of laminae; common medium mottles of faint pink (5YR 7/4); slightly hard, friable when moist, slightly sticky and nonplastic when wet; few very fine roots; common fine vesicular pores; few very fine lime nodules; calcareous; moderately alkaline (pH 8.2).

Reaction to a depth of 40 inches ranges from mildly to moderately alkaline. In the A horizon hue ranges from 5YR through 7.5YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma is 3 or 4. In the A horizon content of organic matter is less than 1 percent. In the C horizon hue ranges from 5YR through 10YR, value from 6 through 7 when dry and from 4 through 6 when moist, and chroma from 3 through 5. The C horizon is mostly coarser than loamy very fine sand. Thin strata of material as fine as fine sandy loam are always present but vary in quantity and range to about 2 inches in thickness. A IIC2 horizon is common but not always present. When present it ranges to about 24 inches in thickness and is generally underlain by coarse sand.

Minneosa loamy fine sand (0 to 3 percent slopes) (Mn).—This soil is nearly level to gently undulating. It is on low terraces and flood plains.

The profile of this soil is similar to that described as representative for the series, but the surface layer is light reddish-brown loamy fine sand about 8 inches thick. Included in mapping were areas of Lacita soils and of Riverwash.

Runoff is very slow on this Minneosa soil. The hazard of soil blowing is severe. This soil is subject to occasional flooding.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIIe; Deep Sand range site; wildlife habitat group B.

Minneosa loamy fine sand (0 to 3 percent slopes) (MO).—This soil is nearly level to gently undulating. It is on low terraces and flood plains.

This soil has the profile described as representative for the Minneosa series. Included in mapping were small tracts of Lacita and San Jose soils and of Riverwash.

Runoff is very slow on this Minneosa soil. The hazard of soil blowing is severe. This soil is subject to occasional flooding.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIIe; Deep Sand range site; wildlife habitat group B.

Montoya Series

The Montoya series consists of deep, well-drained soils that formed in fine-textured alluvium derived from red-bed shale. They are on channeled flood plains, low terraces, and alluvial fans. Slopes are 0 to 3 percent. The vegetation is principally short and mid grasses and shrubs. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the San Jon and Lacita series.

In a representative profile the surface layer is reddish-brown clay loam about 4 inches thick (fig. 8). The subsoil and substratum are reddish-brown clay to a depth of 60 inches or more. The soil is moderately to strongly calcareous throughout the profile. Some salt is in the subsoil and substratum, and gypsum crystals are in the substratum.

Permeability is very slow in the Montoya soils. Available water holding capacity is 7 to 9 inches. Effective rooting depth is 60 inches or more.

These soils are used for range, as wildlife habitat, for watershed, and for irrigated crops.

Representative profile of Montoya clay loam, NE¼SE¼SW¼ sec. 30, T. 8 N., R. 29 E.:

A1—0 to 4 inches, reddish-brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, thin, platy structure in upper 1 inch that grades to weak, fine, subangular blocky; slightly hard, friable when moist, sticky and plastic when wet; many fine roots; common fine vesicular and few fine tubular pores; moderately calcareous; mildly alkaline (pH 7.6); abrupt, smooth boundary. 4 to 6 inches thick.

B21—4 to 18 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, medium, subangular blocky structure; close-fitting surfaces on peds, very few small voids between them in undisturbed condition; very hard, firm when

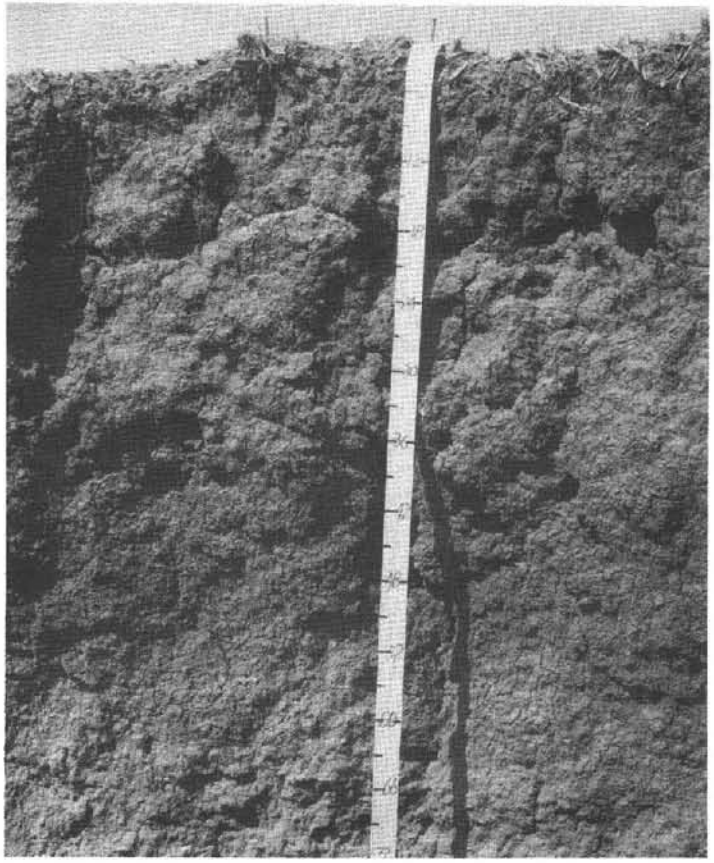

Figure 8.—**Profile of Montoya clay loam.**

moist, sticky and plastic when wet; many fine roots in upper part, common in lower part; common micro and few fine tubular pores; few weakly expressed slickensides; strongly calcareous; moderately alkaline (pH 7.9); gradual, wavy boundary. 8 to 20 inches thick.

B22—18 to 33 inches, reddish-brown (2.5YR 5/4) clay, (2.5YR 4/4) when moist; moderate, medium, angular blocky structure; very hard, very firm when moist, very sticky and very plastic when wet; few fine to medium roots; common fine tubular pores; common intersecting slickensides; pressure faces on some soil peds; strongly calcareous; moderately alkaline (pH 8.0); gradual, irregular boundary. 12 to 20 inches thick.

Cca—33 to 60 inches, reddish-brown (2.5YR 5/4) clay, (2.5YR 4/4) when moist; massive; very hard, very firm when moist, very sticky and very plastic when wet; few fine roots; few fine tubular pores; few to common, soft concretions and coatings of calcium carbonate ($CaCO_3$) in cracks; few scattered clusters of fine gypsum crystals; strongly calcareous; moderately alkaline (pH 8.0).

In the A horizon hue ranges from 2.5YR through 7.5YR, and value from 3 through 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. In the B horizon hue ranges from 2.5YR through 7.5YR, value from 4 through 6 when dry and from 3 through 5 when moist, and chroma from 4 through 6. The A horizon normally is free of soluble salts, but in places in irrigated areas it ranges to moderately affected by salts and alkali. The B horizon is heavy clay loam and heavy silty clay loam to silty clay and clay. The clay content ranges from 35 to 60 percent. In the B horizons structure is weak to moderate, angular blocky, and intersecting slickensides are few to common. Cracks more than 1 centimeter in width at depths of 20 inches range from few to many. The B and C horizons are slightly to strongly affected by soluble salts. The C horizon is less than 15 percent calcium carbonate. Carbonates range from disseminated to common, fine, soft masses and concretions. Accumulations of gypsum range from none to slight.

Montoya clay loam (0 to 3 percent slopes) (MP).—This soil is level to nearly level. It is on channeled flood plains and low terraces.

This soil has the profile described as representative for the Montoya series. Included in mapping were areas of Tucumcari and Lacita soils.

Runoff is medium on this Montoya soil. Additional water is received as runoff from surrounding soils. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIew; Salt Flats range site; wildlife habitat group D.

Montoya clay loam, 0 to 1 percent slopes (Mr).—This soil is level. It is on channeled flood plains.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown heavy clay loam about 6 inches thick. Included in mapping were small tracts of Tucumcari, Redona, and San Jon soils.

Runoff is medium on this Montoya soil. If not protected by diversions, this soil receives additional water that runs from surrounding soils. The hazard of water erosion is slight to moderate. This soil is moderately affected by soluble salts and alkali in places where it is irrigated.

This soil is used for range and irrigated crops, as wildlife habitat, and for watershed. Irrigated capability unit IVs–3; dryland capability subclass VIew; Salt Flats range site; wildlife habitat group D.

Montoya clay loam, 1 to 3 percent slopes (Ms).—This soil is nearly level. It is on channeled flood plains and low terraces.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown heavy clay loam about 5 inches thick. Included in mapping were small tracts of Tucumcari, Lacita, Quay, and San Jon soils.

Runoff is medium on this Montoya soil. If not protected by diversions, this soil receives additional water that runs from surrounding soils. The hazard of water erosion is slight to moderate. This soil is moderately affected by soluble salts and alkali in places where it is irrigated.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVs–3; dryland capability subclass VIew; Salt Flats range site; wildlife habitat group D.

Montoya clay loam and Gullied land (0 to 3 percent slopes) (MT).—Montoya clay loam makes up about 45 percent of this undifferentiated group, and Gullied land makes up about 45 percent. Included soils make up the other 10 percent. Montoya clay loam is level to nearly level and is on channeled flood plains. Gullied land consists of a network of gullies 5 to 30 feet deep that have tributary gullies 2 to 5 feet deep. This land is almost completely lacking in vegetation.

The Montoya soil has a profile similar to that described as representative for the Montoya series, but

most of the surface layer has been removed by rill erosion.

Included with this group in mapping were areas of Tucumcari clay loam and Lacita silt loam. Each of these included areas makes up about 5 percent of the mapped acreage of this undifferentiated group.

Runoff is rapid on the soils of this group. Additional water is received as runoff from surrounding soils. The hazard of water erosion is severe. Active soil piping occurs in the soils of this group.

The soils of this undifferentiated group are used for range and watershed and as wildlife habitat. Montoya clay loam in dryland capability subclass VIew, Salt Flats range site, wildlife habitat group D; Gullied land in dryland capability subclass VIIIe, range site not assigned, wildlife habitat group F.

Olton Series

The Olton series consists of deep, well-drained soils that formed in moderately fine textured old alluvium modified by wind on the High Plains. Slopes are 0 to 3 percent. The vegetation is mid and short grasses, forbs, and shrubs. Elevation ranges from 4,400 to 5,000 feet. The average annual precipitation is 15 to 18 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Amarillo, Potter, and Bascom series.

In a representative profile the surface layer is yellowish-brown and brown loam about 9 inches thick. The subsoil is brown heavy clay loam about 25 inches thick. The substratum is reddish-yellow clay loam and yellowish-red sandy clay loam. It has a high content of lime. The surface layer and upper part of the subsoil are noncalcareous.

Permeability is moderately slow in the Olton soils. Available water holding capacity is 10 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for range, as wildlife habitat, and for watershed. A limited acreage is in dryfarmed crops.

Representative profile of Olton loam, 0 to 3 percent slopes, NW¼SW¼NW¼ sec. 3, T. 16 N., R. 35 E.:

A11—0 to 3 inches, yellowish-brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) when moist; moderate, medium, platy structure that parts to weak, fine, granular; slightly hard, very friable when moist, nonsticky and slightly plastic when wet; many fine roots; many fine vesicular pores; noncalcareous; neutral (pH 6.8); abrupt, smooth boundary. 0 to 4 inches thick.

A12—3 to 9 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable when moist, nonsticky and slightly plastic when wet; many fine roots; many fine tubular pores; noncalcareous; neutral (pH 7.0); clear, smooth boundary. 6 to 8 inches thick.

B2t—9 to 28 inches, brown (10YR 5/3) heavy clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm when moist, sticky and plastic when wet; common fine roots; common fine tubular pores; thin patchy clay films; noncalcareous; mildly alkaline (pH 7.5); abrupt, smooth boundary. 16 to 28 inches thick.

B3ca—28 to 34 inches, brown (7.5YR 5/4) clay loam, (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and plastic when wet; few fine roots; many fine tubular pores; common, fine, distinct lime mottles of pinkish white (7.5YR 8/2); strongly calcareous; moderately alkaline (pH 8.0); clear, smooth boundary. 2 to 8 inches thick.

C1ca—34 to 46 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; many fine tubular pores; many, fine and medium, distinct lime nodules of pinkish white (7.5 YR 8/2); 15 to 20 percent calcium carbonate equivalent; strongly calcareous; moderately alkaline (pH 8.0); gradual, smooth boundary. 10 to 20 inches thick.

IIC2—46 to 60 inches, yellowish-red (5YR 5/6) sandy clay loam, (5YR 4/6) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; very few fine roots; many fine tubular pores; moderately calcareous; mildly alkaline (pH 7.8).

In the A horizon hue ranges from 7.5YR to 10YR. This horizon ranges from loam to light clay loam. The Bt horizon ranges from sandy clay to heavy clay loam in which 35 to 40 percent of the soil material is clay.

Olton loam, 0 to 3 percent slopes (OT).—This soil is smooth and level to nearly level. It is on uplands of the High Plains in the eastern and northeastern parts of the Area.

Included with this soil in mapping were small areas of Amarillo and Bascom soils, and of Canez variant.

Runoff is slow to medium on this Olton soil. The hazard of erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. A limited acreage is in dryfarmed crops. Dryland capability unit IIIec–1; Loamy range site; wildlife habitat group A.

Potter Series

The Potter series consists of well-drained soils that are shallow over cemented caliche. They formed in beds of caliche on the High Plains. Slopes are 1 to 9 percent. The vegetation is mostly mid grasses, mesquite, and yucca. Elevation ranges from 4,200 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Bascom and Amarillo series, and in the Canez variant.

In a representative profile the surface layer is light brownish-gray loam about 8 inches thick. The substratum is very pale brown, fractured, cemented caliche.

Permeability is moderate in the Potter soils. Available water holding capacity is 1 to 1.5 inches. Effective rooting depth is 6 to 10 inches.

These soils are used for range, as wildlife habitat, for watershed, and as a source of caliche for construction.

Representative profile of Potter loam, 1 to 9 percent slopes, NW¼NW¼SE¼ sec. 13, T. 12 N., R. 33 E.:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) loam, yellowish brown (10YR 5/4) when moist; weak, medium, granular structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; about 30 percent very pale brown (10YR 8/4), medium fragments of caliche; many fine roots; few fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt, wavy boundary. 6 to 10 inches thick.

Ccam—8 inches, very pale brown (10YR 8/3), fractured, cemented caliche; few fine roots and soil in cracks; caliche more fragmented, softer, and mixed with loamy material below depth of 14 inches.

In the A horizon hue ranges from 7.5YR through 10YR. Value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 through 4. This horizon ranges from loam to fine sandy loam. The Ccam horizon is at a depth of 6 to 10 inches.

Potter loam, 1 to 9 percent slopes (Po).—This soil is nearly level to moderately sloping. It is on uplands of the High Plains.

The profile of this soil is similar to that described as representative for the series, but the surface layer is light-brown loam.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Bascom soils of Canez variant.

Runoff is medium to rapid on this Potter soil. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and as a source of caliche. Dryland capability subclass VIIs; Shallow range site; wildlife habitat group C.

Potter loam, 1 to 9 percent slopes (PT).—This soil is nearly level to moderately sloping. It is on uplands of the High Plains.

This soil has the profile described as representative for the Potter series.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Bascom and Sharvana soils. Also included, and making up about 5 percent of the mapped acreage of this soil, were areas of soils that are similar to Potter loam, except that they are underlain by indurated caliche at a depth of 6 to 16 inches. These soils are mostly along the boundary of Deaf Smith County.

Runoff is medium to rapid on this Potter soil. The hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, for watershed, and as a source of caliche. Dryland capability subclass VIIs; Shallow range site; wildlife habitat group C.

Quay Series

The Quay series consists of moderately deep to deep, well-drained soils that formed in mixed alluvium derived principally from red-bed material. They are on alluvial fans. Slopes are 0 to 9 percent. The vegetation is principally mid grasses, forbs, and shrubs. Elevation ranges from 4,000 to 4,800 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Redona, Ima, and Canez series.

In a representative profile the surface layer is reddish-brown and light reddish-brown loam and heavy loam about 9 inches thick. The subsoil is light reddish-brown and reddish-brown light clay loam and clay loam about 17 inches thick. The substratum, to a depth of 60 inches or more, is light-brown and pinkish-gray clay loam and light clay loam having a high content of lime. The soil is calcareous throughout the profile.

Permeability is moderate in the Quay soils. Available water holding capacity is 5 to 6 inches. Rooting depth to the lime zone is 15 to 38 inches.

These soils are used for range, as wildlife habitat, and for watershed. A limited acreage is in irrigated crops.

Representative profile of Quay loam, 0 to 5 percent slopes, in the north quarter corner of sec. 27, T. 10 N., R. 30 E.:

A1—0 to 3 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) when moist; moderate, very fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many fine vesicular and few fine tubular pores; disseminated lime; calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 2 to 5 inches thick.

A3—3 to 9 inches, light reddish-brown (5YR 6/3) heavy loam, reddish brown (5YR 4/3) when moist; moderate, very fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common very fine tubular pores; disseminated lime; calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 4 to 10 inches thick.

B21—9 to 13 inches, light reddish-brown (5YR 6/3) light clay loam, reddish brown (5YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; common very fine and few fine roots; common fine tubular pores; disseminated lime; calcareous; moderately alkaline (pH 8.4); clear, smooth boundary. 3 to 6 inches thick.

B22—13 to 19 inches, reddish-brown (5YR 5/4) clay loam, (5YR 4/4) when moist; moderate, fine, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common very fine and few fine roots; common fine tubular pores; lime segregated into few, fine, soft masses; calcareous; moderately alkaline (pH 8.4); clear, wavy boundary. 5 to 15 inches thick.

B3ca—19 to 26 inches, reddish-brown (5YR 5/4) clay loam, (5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; common very fine and few fine roots; common fine and very fine tubular pores; lime segregated into many, pinkish-white (5YR 8/2), medium, soft masses; calcareous; moderately alkaline (pH 8.4); clear, wavy boundary. 6 to 12 inches thick.

C1ca—26 to 36 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, firm when moist, sticky and plastic when wet; few very fine roots; common fine and very fine tubular pores; lime segregated into many, pinkish white (5YR 8/2), medium, soft masses; calcareous; moderately alkaline (pH 8.4); clear, smooth boundary. 5 to 12 inches thick.

C2—36 to 60 inches, pinkish-gray (7.5YR 7/2) light clay loam, (7.5YR 6/2) when moist; massive; slightly hard, friable when moist, sticky and plastic when wet; few very fine tubular pores; few, fine, soft masses of lime; calcareous; moderately alkaline (pH 8.4).

In the upper 7 inches, the A horizon is less than 1 percent organic matter. In the A horizon hue ranges from 2.5YR through 7.5YR, and value is 5 or 6 when dry. Chroma ranges from 3 through 5. This horizon is loam or fine sandy loam. In the B horizon hue is 2.5YR or 5YR, and value ranges from 5 through 7 when dry and from 3 through 5 when moist. Chroma ranges from 3 through 6. This horizon ranges from 18 to 35 percent clay, and is less than 15 percent fine and coarser sand. In the B horizon structure is weak and moderate, fine to coarse, prismatic and subangular blocky. The B3ca horizon begins at a depth of 15 to 36 inches and averages about 24 inches. In the C1ca horizon hue ranges

from 2.5YR through 7.5YR, value from 5 through 7 when dry and from 4 through 6 when moist, and chroma from 2 through 4. The C1ca horizon ranges from 15 to 30 percent calcium carbonate, and on the average is 5 percent more than in the C2 horizon.

Quay fine sandy loam, 0 to 1 percent slopes (Qd).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is fine sandy loam about 7 inches thick.

Included with this soil in mapping, and making up about 13 percent of the mapped acreage, were areas of Redona, La Lande, and Ima soils. Also included, and making up about 2 percent of the mapped acreage of this soil, were areas of Quay fine sandy loam, sandstone substratum.

Runoff is slow on this Quay soil. The hazard of soil blowing is moderate.

This soil is used for range and as wildlife habitat. A limited acreage is in irrigated crops. Irrigated capability unit IIe–3; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Quay fine sandy loam, 1 to 3 percent slopes (Qe).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown fine sandy loam about 6 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Redona, La Lande, and Ima soils.

Runoff is slow on this Quay soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe–4; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Quay loam, 0 to 1 percent slopes (Qf).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam about 7 inches thick.

Included with this soil in mapping, and making up about 13 percent of the mapped acreage, were areas of Redona, Lacita, and La Lande soils. Also included, and making up about 2 percent of the mapped acreage of this soil, were areas of Quay loam, shale substratum.

Runoff is slow on this Quay soil. The hazard of soil blowing is moderate.

This soil is used for irrigated crops and range, and as wildlife habitat. Irrigated capability unit IIe–1; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, 1 to 3 percent slopes (Qg).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown loam about 8 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Redona, Lacita, and La Lande soils.

Runoff is medium on this Quay soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IIIe–6; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, 0 to 5 percent slopes (QH).—This soil is level to gently sloping. It is on upland alluvial fans.

This soil has the profile described as representative for the Quay series. Included in mapping were areas of Tucumcari, Redona, Lacita, and Montoya soils. Also included were a few small areas of Olton soils along the boundary of Deaf Smith County.

Runoff is slow to medium on this Quay soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, 3 to 9 percent slopes (Qk).—This soil is gently sloping to moderately sloping. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is light reddish-brown loam about 6 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of San Jon, Lacita, and La Lande soils.

Runoff is rapid on this Quay soil. The hazards of soil blowing and water erosion are moderate to severe.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVe–13; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, sandstone substratum, 0 to 1 percent slopes (Ql).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but sandstone bedrock is at a depth of 24 to 38 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped acreage, were areas of Quay fine sandy loam, sandstone substratum. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of La Lande, Ima, Los Tanos, and Lacita soils.

Runoff is slow on this Quay soil. The hazard of soil blowing is moderate. Available water holding capacity is 5 to 6 inches. Effective rooting depth is 24 to 38 inches. If irrigation water is not properly managed, a perched water table forms over the sandstone bedrock in places.

This soil is used for irrigated crops and range, and as wildlife habitat. Irrigated capability unit IIIe–6; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, sandstone substratum, 1 to 3 percent slopes (Qm).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but sandstone bedrock is at a depth of 22 to 36 inches.

Included with this soil in mapping, and making up about 30 percent of the mapped acreage, were areas of Quay fine sandy loam, sandstone substratum. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of La Lande, Ima, Los Tanos, and Redona soils.

Runoff is medium on this Quay soil. The hazards of

soil blowing and water erosion are moderate. Effective rooting depth is 22 to 36 inches. If irrigation water is not properly managed, a perched water table forms over the sandstone bedrock in places.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IIIe–6; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, shale substratum, 1 to 3 percent slopes (Qn).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the substratum is shale at a depth of 20 to 35 inches.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Quay fine sandy loam, shale substratum. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of San Jon and Ima soils.

Runoff is medium on this Quay soil. The hazards of soil blowing and water erosion are moderate. Available water holding capacity is 4 to 5 inches. Effective rooting depth is 20 to 35 inches. If irrigation water is not properly managed, a perched water table forms over the shale substratum in places.

This soil is used for range, as wildlife habitat, for watershed, and for irrigated crops. Irrigated capability unit IVe–1; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Quay loam, shale substratum, 1 to 5 percent slopes (QO).—This soil is nearly level to gently sloping. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the substratum is shale at a depth of 20 to 35 inches.

Included with this soil in mapping, and making up about 40 percent of the mapped acreage, were areas of Quay fine sandy loam, shale substratum. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of San Jon and Ima soils.

Runoff is medium on this Quay soil. The hazards of soil blowing and water erosion are moderate. Available water holding capacity is 4 to 5 inches. Effective rooting depth is mostly 20 to 35 inches.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Redona Series

The Redona series consists of deep, well-drained soils that formed in old alluvium on alluvial fans and valley sides. Slopes are 0 to 5 percent. The vegetation is mixed mid and tall grasses, forbs, and shrubs. Elevation ranges from 4,200 to 4,600 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Ima, Los Tanos, and Quay series.

In a representative profile the surface layer is reddish-brown fine sandy loam about 10 inches thick. The upper part of the subsoil is reddish-brown sandy clay loam about 18 inches thick. The lower part of the subsoil and the substratum, to a depth of 68 inches or more, are pink and light reddish-brown clay loam having a high content of lime. The upper 24 inches of the soil is noncalcareous.

Permeability is moderate in the Redona soils. Available water holding capacity is 9.5 to 11 inches. Effective rooting depth is 60 inches or more.

The Redona soils are used for range, as wildlife habitat, for watershed, and for irrigated crops. A few small areas are in irrigated pasture. The Redona soils are dry too much of the time to be suitable for dryfarmed crops.

Representative profile of Redona fine sandy loam, 0 to 3 percent slopes, about 4 miles south of Tucumcari on State Highway 18 and one-half mile north of the southwest corner of sec. 15, T. 10 N., R. 30 E.:

A1—0 to 10 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, thin, platy structure in upper 2 inches that grades to weak, fine and medium, subangular blocky; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine roots; common fine vesicular and few fine tubular pores; noncalcareous; mildly alkaline (pH 7.4); clear, smooth boundary. 6 to 12 inches thick.

B21t—10 to 24 inches, reddish-brown (5YR 5/4) sandy clay loam, (5YR 4/4) when moist; weak, coarse, prismatic structure and moderate, fine and medium, subangular blocky; hard, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine roots; common fine and few medium tubular pores; common clusters of fine, rounded insect casts; clay as many thin coatings on sand grains, and as bridges between grains; noncalcareous; mildly alkaline (pH 7.5); clear, smooth boundary. 12 to 16 inches thick.

B22t—24 to 28 inches, reddish-brown (5YR 5/4) sandy clay loam, (5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; hard, friable when moist, slightly sticky and nonplastic when wet; common very fine and fine roots; many fine and medium tubular pores; common clusters of fine rounded insect casts; clay as many thin coatings on sand grains, and as bridges between grains; few, fine, soft nodules and concretions of lime; calcareous; mildly alkaline (pH 7.6); abrupt, wavy boundary. 3 to 8 inches thick.

B3ca—28 to 50 inches, pink (5YR 8/3) and light reddish-brown (5YR 6/4) clay loam, pink (5YR 7/3) and reddish brown (5YR 5/4) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many very fine tubular pores; common very fine and fine pebbles; lime disseminated throughout; few very fine lime concretions; calcareous; moderately alkaline (pH 8.3); clear, wavy boundary. 15 to 24 inches thick.

Cca—50 to 68 inches, light reddish-brown (5YR 6/4) and pink (5YR 8/3) clay loam, reddish brown (5YR 5/4) and pink (5YR 7/3) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; lime disseminated throughout; few very fine lime concretions; calcareous; moderately alkaline (pH 8.2).

Content of course fragments of all horizons is less than 15 percent. Thickness of the A and B horizons ranges from 36 to 60 inches. The solum ranges from noncalcareous in the upper part to calcareous throughout, and from mildly alkaline to strongly alkaline. Noncontrasting buried horizons are present in places below the solum. In the A horizon hue ranges from 7.5YR through 5YR, value is 4 or 5 when dry and 3 or 4 when moist, and chroma is 4 or 5. The A horizon ranges from loamy fine sand to sandy clay loam. In the B2t horizon hue ranges from 7.5YR through 2.5YR, and value

from 4 through 6 when dry and 3 through 5 when moist. Chroma is 4 or 5. In the B3ca horizon hue has the same range as in the B2t horizon, but value is one to three units higher because of greater content of carbonates. In the layer of maximum accumulation, content of carbonates exceeds 15 percent, and more than 5 percent of the carbonates are in secondary form. Content of carbonates decreases with further depth.

Redona loamy fine sand, 0 to 3 percent slopes (Rd).—This soil is nearly level to gently undulating. It is on valley sides of uplands.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown loamy fine sand about 9 inches thick. Included in mapping were small tracts of Canez, Ima, and Bascom soils.

Runoff is very slow to slow on this Redona soil. The hazard of soil blowing is severe.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe–10; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Redona loamy fine sand, 0 to 3 percent slopes (RE).—This soil is nearly level to gently undulating. It is on upland alluvial fans and valley sides.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown loamy fine sand about 12 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Redona loamy fine sand, 3 to 5 percent slopes. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of Canez and Bascom soils.

Runoff is very slow to slow on this Redona soil. The hazard of soil blowing is severe.

This soil is used for range, as wildlife habitat, and for irrigated crops. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Redona loamy fine sand, 0 to 3 percent slopes, eroded (RF).—This soil is gently undulating. It is on upland valley sides and alluvial fans in abandoned fields that were formerly used for dryfarmed crops.

The profile of this soil is similar to that described as representative for the series, but the surface layer has been eroded.

About 60 percent of this mapping unit consists of low hummocks of accumulated loamy fine sand, 2 to 4 feet high. About 25 percent consists of areas where the surface layer has been blown away and the sandy clay loam subsoil has been exposed. A few blowouts are present in places where the subsoil has been blown away and the high-lime substratum has been exposed.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Canez, Ima, and Bascom soils.

Runoff is slow on this Redona soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Redona loamy fine sand, 3 to 5 percent slopes (Rg).—This soil is undulating. It is on upland valley sides.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown loamy fine sand about 8 inches thick. Included in mapping were a few small tracts of Canez and Bascom soils.

Runoff is medium on this Redona soil. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. A limited acreage is in irrigated crops. Irrigated capability unit IVe–13; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Redona loamy fine sand, 0 to 3 percent slopes, hummocky (Rh).—This soil is gently undulating. It is on upland alluvial fans in old fields that were formerly used for dryfarmed crops.

The profile of this soil is similar to that described as representative for the series, but the surface layer has been eroded. About 65 percent of this mapping unit consists of low hummocks of accumulated loamy fine sand, 2 to 4 feet high. Hummocks of loamy fine sand 3 to 6 feet high are commonly present along the northern and eastern boundaries of the old fields. About 20 percent of the unit consists of areas where the surface layer has been blown away and the sandy clay loam subsoil has been exposed. A few blowouts are present in places where the subsoil has been blown away and the high-lime clay loam substratum has been exposed.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were acres of Canez, Ima, and Bascom soils.

Runoff is slow on this Redona soil. The hazard of soil blowing is severe.

This soil is used mostly for range and as wildlife habitat. A few small tracts are used for irrigated pasture or crops. Irrigated capability unit IVe–8; dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Redona fine sandy loam, 0 to 1 percent slopes (Rk).—This soil is level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown fine sandy loam about 8 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Canez and Bascom soils, and of Bascom variant.

Runoff is slow on this Redona soil. The hazard of soil blowing is moderate.

This soil is used for irrigated crops and range, and as wildlife habitat. Irrigated capability unit IIe–3; dryland capability subclass VIe; Sandy range site; wildlife habitat Group A.

Redona fine sandy loam, 0 to 3 percent slopes (RM).—This soil is level to nearly level. It is on upland and alluvial fans and valley-filling slopes.

This soil has the profile described as representative for the Redona series. Included in mapping were areas of Tucumcari, La Lande, Amarillo, and Quay soils.

Runoff is slow on this Redona soil. The hazard of soil blowing is moderate.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Redona fine sandy loam, 1 to 3 percent slopes (Rn).—This soil is nearly level. It is on upland alluvial fans and valley sides.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown fine sandy loam about 7 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Canez and La Lande soils and of Canez variant.

Runoff is slow on this Redona soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for irrigated crops. Irrigated capability unit IIIe–4; dryland capability subclass VIe; Sandy range site; wildlife habitat group A.

Redona loam, 0 to 1 percent slopes (Ro).—This level soil is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam or sandy clay loam about 6 inches thick.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Quay, La Lande, Lacita, and Tucumcari soils.

Runoff is slow on this Redona soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, and as wildlife habitat. Irrigated capability unit IIe–1; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Redona loam, 1 to 3 percent slopes (Rp).—This soil is nearly level. It is on upland alluvial fans and valley sides.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam or sandy clay loam about 6 inches thick.

Included with this soil in mapping were a few small tracts of Redona loam, 3 to 5 percent slopes, and of Quay, La Lande, and Lacita soils.

Runoff is medium on this Redona soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe–8; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Riverwash

One part of this land type has been mapped in the high-intensity survey area, and another part has been mapped in the medium-intensity survey area.

Riverwash (0 to 3 percent slopes) (Rr).—This part of the Riverwash land type consists of areas along the bottoms of small intermittent stream channels and the low-lying sand and gravel terraces of larger creeks in the high-intensity survey area. Such streams include Pajarito Creek and Plaza Largo Creek. These areas are subject to frequent overflow from upstream runoff. They are also subject to deposition and erosion. The vegetation is sparse, consisting of a few annual weeds and some cottonwood and saltcedar. Elevation ranges from 3,800 to 4,200 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Included in mapping, and making up about 10 percent of the mapped acreage of this land type, were areas of Lacita, Minneosa, and Galegos soils.

Permeability is mostly rapid in the soil material of this land type. Runoff is medium to rapid. The hazard of erosion is severe.

Areas of this land type are used for watershed and as a source of commercial sand and gravel. Dryland capability subclass VIIIw; range site not assigned; wildlife habitat group F.

Riverwash (0 to 3 percent slopes) (RS).—This part of the Riverwash land type consists of interbedded soil material that is mostly sand and gravel having thin strata of silt loam. Areas of this material are in the channel and adjacent low flood plains of the Canadian River and its tributaries in the medium-intensity survey area. These areas are subject to frequent overflow, deposition, and erosion. Elevation ranges from 3,600 to 4,500 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Included in mapping, and making up about 10 percent of the mapped acreage of this land type, were areas of Minneosa, Lacita, and Gallegos soils.

Permeability is mostly rapid in the soil material of this land type. Runoff is medium to rapid. The hazard of erosion is severe.

Areas of this land type are used for watershed and as a source of sand and gravel. In some places pools of water serve as intermittent watering areas for livestock and wildlife. Dryland capability subclass VIIIw; range site not assigned; wildlife habitat group F.

Rock Land

Rock land (20 to 80 percent slopes) (Rt) (RU) is made up of two distinct landforms in the medium-intensity survey area. The vegetation on this land type is sparse, widely variable, and in many places inaccessibe to livestock. It consists of short and mid grasses, scrub oak, juniper, skunkbush sumac, mesquite, yucca, saltcedar, and some cottonwood. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

One landform is known locally as the High Plains Escarpment. It consists of soils that are hilly to very steep. Relief averages about 400 feet. These soils are shallow and very shallow and have many outcrops of sandstone and caliche material overlying interbedded red-bed shale and sandstone. Elevation ranges from 4,500 to 5,000 feet. Included in mapping were areas of Potter soils that are gently to strongly sloping at the top of the escarpment. Also included were areas of Quay, Montoya, and La Lande soils at the base of the escarpment. These inclusions make up less than 10 percent of the mapped acreage of any single delineation of this landform. Gully erosion is common at the base of the escarpment.

The other landform is known locally as the River Breaks. It consists of soils that are hilly to very steep.

These soils are in many deep canyons along the Canadian River and its tributaries. About 60 percent of the landform is sandstone outcrops, about 30 percent is very shallow and shallow soils over bedrock, and about 10 percent is included soils. Elevation ranges from 3,600 to 4,400 feet. Included in mapping were areas of Rough broken and stony land, steep. Also included were areas of rolling, gravelly Gallegos soils at the top of the breaks.

A few minor tracts of this land type are in the high-intensity survey area. These tracts differ from those in the medium-intensity survey area mostly in that relief averages about 100 feet. Included in mapping were areas of mostly Latom and Lacita soils.

Runoff is rapid on the soils of this land type. The hazard of water erosion is severe.

Areas of this land type are used as wildlife habitat, for recreation, and for watershed. A limited acreage is used for range. These areas are also used as a source of caliche or gravel for building and highway construction. Dryland capability subclass VIIs; Breaks range site; wildlife habitat group E.

Rough Broken and Stony Land

One part of this land type has been classified as hilly, and another part has been classified as steep.

Rough broken and stony land, hilly (Rv) (RW).—This part of the land type consists of shale breaks, stone-covered, sloping soils, remnants of eroded terraces, and short alluvial fans in both the high-intensity and medium-intensity survey areas. Slopes are generally 15 to 25 percent. The vegetation is short and mid grasses, juniper, and mesquite. Elevation ranges from 3,700 to 4,300 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

In the high-intensity survey area about 85 percent of this land type is very shallow to shallow soils over weakly consolidated shale and sandstone; about 5 percent is rock outcrops; and about 10 percent is included soils. The soils included in mapping were the Montoya, Lacita, Ima, and Quay.

In the medium-intensity survey area about 75 percent of this land type is very shallow or shallow soils over weakly consolidated shale and sandstone; about 5 percent is rock outcrops; and about 20 percent is included soils. The soils included in mapping were the Montoya, Lacita, and Quay.

Permeability is slow to moderate in the soils of this land type. Available water holding capacity is 0 to 2 inches. Effective rooting depth is 0 to 12 inches. Runoff is rapid. The hazard of water erosion is severe. The more eroded areas of this land type are generally barren.

Areas of this land type are used as wildlife habitat and for watershed. A limited acreage is used for range. Dryland capability subclass VIIe; Hills range site; wildlife habitat group E.

Rough broken and stony land, steep (Rx) (RY).—This part of the land type consists of shale breaks, erosional remnants, stone-covered, sloping soils, and short alluvial fans in both the high-intensity and medium-intensity survey areas. The breaks are actively eroding and have numerous gullies and fans eroding out from the base of escarpments. The geologic material is a mixture of red shale, siltstone, and sandstone. Slopes are 25 to 75 percent. The vegetation is sparse. Elevation ranges from 3,700 to 4,600 feet. The average annual precipitation is 13 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days.

In the high-intensity survey area slopes are mostly short. Included in mapping were areas of San Jon, Lacita, Montoya, and Latom soils. These inclusions make up about 15 percent of the mapped acreage of this land type in the high-intensity survey area.

In the medium-intensity survey area slopes are mostly long. Included in mapping were areas of Lacita, San Jon, and Montoya soils at the base of escarpments. These inclusions make up about 15 percent of the mapped acreage of this land type in the medium-intensity survey area. Also included, and making up about 5 percent of the mapped acreage, were areas of Latom and Los Tanos soils on the upper rim of escarpments.

Permeability is slow in the soils of this land type. Runoff is rapid to very rapid. The hazard of water erosion is severe. Silt sediment from this land type is commonly deposited on the surrounding lower areas.

Areas of this land type are used as wildlife habitat, for watershed, and for recreation. Use of these areas for range is limited because of the sparse vegetation. These areas, however, afford good protection to livestock during severe storms. In places this land type has considerable esthetic value (fig. 9). Dryland capability subclass VIIe; Breaks range site; wildlife habitat group E.

San Jon Series

The San Jon series consists of well-drained soils that are moderately deep over interbedded shale and sandstone. These soils formed in material weathered from red-bed shale, sandstone, and some mixed alluvium. They are on erosional remnant pediments. Slopes are 1 to 5 percent. The vegetation is mostly mid grasses, and some tobosa and alkali sacaton. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 175 to 195 days. Associated soils are in the Montoya, La Lande, and Quay series.

In a representative profile the surface layer is reddish-brown loam and heavy loam about 8 inches thick. The underlying layers are reddish-brown and light reddish-brown to red gravelly light clay loam to silty clay loam about 18 inches thick. The substratum is red fragmental shale at a depth of about 26 inches.

Permeability is moderately slow in the San Jon soil. Available water holding capacity is 4 to 5 inches. Effective rooting depth is 20 to 40 inches.

These soils are used for range, as wildlife habitat, and for watershed.

Represenatitive profile of San Jon loam, 1 to 5 percent slopes, one-tenth mile south of bridge and 100 feet west of fence on State Highway 93, in the northeast quarter of sec. 34, T. 10 N., R. 36 E.:

A11—0 to 4 inches, reddish-brown (5YR 5/3) loam, (5YR 4/3) when moist; weak, thick, platy structure in upper 1 inch that abruptly overlies compound of weak, medium, subangular and moderate, fine, granu-

Figure 9.—View of Rough broken and stony land, steep.

lar structure; slightly hard, friable when moist, slightly sticky and plastic when wet; common very fine roots; common fine vesicular and few fine tubular pores; common clusters of fine insect casts; 10 percent coarse fragments of very hard caliche and lime-coated sandstone pebbles; calcareous; moderately alkaline (pH 8.0); clear, smooth boundary. 3 to 6 inches thick.

A12—4 to 8 inches, reddish-brown (5YR 5/3) heavy loam, (5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and plastic when wet; many very fine roots; few fine tubular pores; common fine clusters of insect casts; 10 percent coarse fragments of very hard caliche and lime-coated sandstone pebbles; calcareous; moderately alkaline (pH 8.0); clear, smooth boundary, 3 to 6 inches thick.

C1ca—8 to 12 inches, reddish-brown (5YR 5/4) gravelly light clay loam, (5YR 4/4) when moist; strong, medium, granular structure; slightly hard, friable when moist, slightly sticky and plastic when wet; few very fine roots; many fine interstitial pores; few clusters of fine insect casts; 30 percent coarse fragments of mostly very hard caliche and few lime-coated sandstone pebbles; common very fine and fine lime concretions; calcareous; strongly alkaline (pH 8.6); clear, wavy boundary. 3 to 8 inches thick.

C2ca—12 to 17 inches, light reddish-brown (5YR 6/4) light clay loam, reddish brown (5YR 5/4) when moist; very weak, fine, subangular blocky structure; very hard, friable when moist, slightly sticky and plastic when wet; few very fine roots; many fine tubular pores; few clusters of fine insect casts; few, scattered, very hard caliche fragments and lime-coated sandstone pebbles; common very fine lime concretions and fine, soft lime nodules; common, medium, angular shale fragments; calcareous; strongly alkaline (pH 8.6); clear, wavy boundary. 4 to 8 inches thick.

C3—17 to 26 inches, red (2.5YR 5/6) silty clay loam, (2.5YR 4/6) when moist, and relict, fine angular fragments of shale; massive; very hard, firm when moist, sticky and plastic when wet; few very fine roots; few very fine interstitial pores; few fine concretions and soft masses of lime, less visible than in C2ca horizon; calcareous; moderately alkaline (pH 8.4); diffuse, irregular boundary. 6 to 12 inches thick.

C4—26 inches, red (2.5YR 5/6) fragmental shale (2.5YR 4/6) when moist; overlapping, angular, platy fragments of shale rock; weakly calcareous along fracture planes in upper part that becomes noncalcareous in lower part.

Reaction ranges from mildly alkaline to strongly alkaline. Above the shale, content of coarse fragments averages less than 15 percent but ranges to 40 percent in individual horizons. In the A horizon hue ranges from 2.5YR through 7.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 3 to 4. The A horizon ranges from loam to silt loam or fine sandy loam. In the C1ca and C2ca horizons hue ranges from 2.5YR through 5YR, value from 5

through 7 when dry and 4 through 6 when moist, and chroma from 4 through 6. The C1 horizon ranges from heavy loam and clay loam to silty clay loam having 25 to 35 percent clay. Maximum content of lime is at a depth ranging from 8 to 20 inches. Slightly altered shale begins at a depth of 20 to 40 inches.

San Jon loam, 1 to 5 percent slopes (Sa).—This soil is nearly level to gently sloping. It is on erosional remnant pediments.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown loam about 6 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of San Jon fine sandy loam and of Quay, Lacita, and Montoya soils.

Runoff is rapid on this San Jon soil. The hazard of water erosion is severe.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Clayey range site; wildlife habitat group C.

San Jon loam, 1 to 5 percent slopes (SB).—This soil is nearly level to gently sloping. It is on erosional remnant pediments.

This soil has the profile described as representative for the San Jon series.

Included with this soil in mapping, and making up about 5 percent of the mapped acreage, were areas of San Jon fine sandy loam. Also included, and making up about 10 percent of the mapped acreage of this soil, were areas of Quay, Lacita, and Montoya soils.

Runoff is rapid on this San Jon soil. The hazard of water erosion is severe.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Clayey range site; wildlife habitat group C.

San Jose Series

The San Jose series consists of deep, well-drained soils that formed in moderately coarse textured sediment on terraces, benches, and alluvial fans. Slopes are 0 to 3 percent. The vegetation is mixed mid and tall grasses, forbs, and shrubs. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Ima and La Lande series.

In a representative profile the surface layer is reddish-brown loam and fine sandy loam about 11 inches thick. The underlying layer is light reddish-brown light sandy clay loam about 18 inches thick. The substratum is light reddish-brown fine sandy loam. The soil is calcareous throughout the profile.

Permeability is moderately rapid in the San Jose soils. Available water holding capacity is 7.5 to 9 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and watershed and as wildlife habitat. A limited acreage is in irrigated crops.

Representative profile of San Jose loam, 0 to 1 percent slopes, 1,000 feet south and 900 feet east of the north corner of sec. 13, T. 10 N., R. 31 E.:

A11—0 to 3 inches, reddish-brown (5YR 5/4) loam, (5YR 4/4) when moist; weak, thin and medium, platy structure; soft, very friable when moist, slightly sticky and nonplastic when wet; common very fine and fine roots; common fine vesicular pores; few fine tubular pores; disseminated lime; calcareous; mildly alkaline (pH 7.7); abrupt, smooth boundary. 3 to 6 inches thick.

A12—3 to 11 inches, reddish-brown (5YR 5/4) fine sandy loam, (5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine roots; common fine tubular pores; disseminated lime; calcareous; mildly alkaline (pH 7.7); clear, wavy boundary. 6 to 12 inches thick.

C1—11 to 29 inches, light reddish-brown (2.5YR 6/4) light sandy clay loam, reddish brown (2.5YR 4/4) when moist; massive; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine roots; very few fine tubular pores; disseminated lime; calcareous; mildly alkaline (pH 7.8); clear, smooth boundary. 15 to 30 inches thick.

C2—29 to 60 inches, light reddish-brown (2.5YR 6/4) fine sandy loam, reddish brown (2.5YR 4/4) when moist; massive; slightly hard, friable when moist, slightly sticky and nonplastic when wet; few very fine roots; very few fine tubular pores; disseminated lime; calcareous; mildly alkaline (pH 7.8).

Content of coarse fragments ranges from 0 to 15 percent. Reaction to a depth of 40 inches ranges from mildly alkaline to moderately alkaline. In places weak stratification is present at a depth of less than 40 inches. In the A horizon hue ranges from 2.5YR through 7.5YR, and value is 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 4 or 5. In the A horizon structure ranges from weak platy to weak granular and subangular blocky. Between depths of 10 and 20 inches carbonates are usually disseminated but in places there are few, fine, soft masses and concretions. In the C horizon hue ranges from 2.5YR through 7.5YR, value from 5 through 7 when dry and 4 through 6 when moist, and chroma from 4 through 6. The C horizon ranges from sandy loam and loam to light sandy clay loam having a weighted average of less than 18 percent clay.

San Jose loam, 0 to 1 percent slopes (Sc).—This soil is level. It is on terraces, benches, and alluvial fans.

This soil has the profile described as representative for the San Jose series.

Included with this soil in mapping, and making up about 35 percent of the mapped acreage, were areas of San Jose loam, 1 to 3 percent slopes. Also included, and making up about 5 percent of the mapped acreage, were areas of La Lande loam.

Runoff is slow on this San Jose soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe-1; dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

San Jose loam, 0 to 3 percent slopes (SD).—This soil is level to nearly level. It is on alluvial fans, terraces, and benches.

The profile of this soil is similar to that described as representative for the series, but the surface layer is light reddish-brown loam about 9 inches thick. Included in mapping were small areas of La Lande and Ima soils.

Runoff is medium on this San Jose soil. The hazards of soil blowing and water erosion are moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Loamy range site; wildlife habitat group A.

Sharvana Series

The Sharvana series consists of well-drained soils that are shallow over indurated caliche. They formed in wind-deposited sediment over caliche on the High Plains. Slopes are 0 to 3 percent. The vegetation is mostly mid and short grasses, yucca, cholla cactus, and mesquite. Elevation ranges from 4,200 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Redona, Bascom, and Potter series.

In a representative profile the surface layer is brown sandy loam about 6 inches thick. The subsoil is brown sandy clay loam about 10 inches thick. Indurated caliche is at a depth of about 16 inches.

Permeability is moderate in the Sharvana soils. Available water holding capacity is 2 to 3 inches. Effective rooting depth is 10 to 20 inches.

These soils are used for range and as wildlife habitat.

Representative profile of Sharvana sandy loam, 0 to 3 percent slopes, NW¼SE¼NE¼ sec. 18, T. 9 N., R. 33 E.:

A1—0 to 6 inches, brown (7.5YR 4/3) sandy loam, dark brown (7.5YR 3/4) when moist; moderate, medium, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine interstitial pores; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 4 to 8 inches thick.

B2t—6 to 16 inches, brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) when moist; moderate, medium, prismatic structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine tubular pores; thin, patchy clay films; calcareous in lower part of horizon; mildly alkaline (pH 7.4); clear, smooth boundary. 6 to 12 inches thick.

Ccam—16 inches, indurated caliche.

In the A horizon hue is 5YR or 7.5YR, and value is 4 or 5 when dry and 3 or 4 when moist. The B2t horizon ranges from light clay loam to sandy clay loam. The Ccam horizon begins at a depth of 10 to 20 inches.

Sharvana sandy loam, 0 to 3 percent slopes (SE).—This soil is nearly level to level. It is on the High Plains.

Included with this soil in mapping were areas of soils that are similar to the Sharvana soils, but they are 20 to 30 inches deep over indurated caliche. Also included were a few small areas of Redona, Potter, and Bascom soils.

Runoff is slow on this Sharvana soil. The hazard of soil blowing is moderate.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Sandy range site; wildlife habitat group C.

Springer Series

The Springer series consists of deep, well-drained soils that formed in wind-worked, old sandy alluvium on the High Plains. Slopes are 0 to 9 percent. The vegetation is mixed mid and tall grasses, sand sagebrush, yucca, and mesquite. Elevation ranges from 4,000 to 4,800 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Amarillo, Tivoli, and Brownfield series.

In a representative profile the surface layer is reddish-brown loamy fine sand about 11 inches thick. The subsoil is reddish-brown fine sandy loam about 25 inches thick. The substratum is reddish-brown loamy sand to a depth of 60 inches or more. The soil is noncalcareous to a depth of 30 to 60 inches.

Permeability is moderately rapid in the Springer soils. Available water holding capacity is 5.5 to 6.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and watershed, and as wildlife habitat. A limited acreage is in dryfarmed crops.

Representative profile of Springer loamy fine sand, 0 to 3 percent slopes, 200 feet west of the northeast corner of sec. 4, T. 14 N., R. 36 E.:

A11—0 to 4 inches, reddish-brown (5YR 5/3) loamy fine sand, dark reddish brown (5YR 3/3) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; many fine roots; very few fine interstitial pores; noncalcareous; neutral (pH 6.8); clear, smooth boundary. 0 to 6 inches thick.

A12—4 to 11 inches, reddish-brown (5YR 5/4) loamy fine sand, dark reddish brown (5YR 3/4) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; noncalcareous; neutral (pH 6.8); clear, smooth boundary. 5 to 14 inches thick.

B2t—11 to 36 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine tubular pores; noncalcareous; mildly alkaline (pH 7.4); gradual boundary. 20 to 40 inches thick.

C—36 to 60 inches, reddish-brown (5YR 5/3) loamy sand, (5YR 4/3) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; very few fine tubular pores; noncalcareous; mildly alkaline (pH 7.7).

In the A horizon hue ranges from 5YR to 7.5YR, and value is 5 or 6 when dry and 3 or 4 when moist. This horizon ranges from loamy fine sand to fine sandy loam. In the B horizon hue ranges from 2.5YR to 5YR, and value is 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 4 through 6. This horizon ranges from heavy fine sandy loam to light sandy loam.

Springer-Amarillo association (0 to 3 percent slopes) (SF).—Springer loamy fine sand makes up about 50 percent of this association, and Amarillo loamy fine sand makes up about 40 percent. Included soils make up the other 10 percent. The Springer and Amarillo soils are nearly level to gently undulating. They are on smoother topography of the High Plains.

The Springer soil has a profile similar to that described as representative for the Springer series, but the surface layer is brown loamy fine sand about 16 inches thick. The Amarillo soil has a profile similar to that described as representative for the Amarillo series, but the surface layer is brown and reddish-brown loamy fine sand about 12 inches thick.

Included with these soils in mapping were areas of Tivoli, Bascom, and Potter soils.

Runoff is very slow on the soils of this association. The hazard of soil blowing is severe.

The soils of this association are used for range and as wildlife habitat. Springer soil in dryland capability subclass VIe, Amarillo soil in dryland capability unit IVe–4; both soils in Deep Sand range site; both soils in wildlife habitat group B.

Springer loamy fine sand, 0 to 3 percent slopes (SG).—This soil is nearly level to gently undulating. It is on uplands of the High Plains in the northeastern part of the Tucumcari Area.

This soil has the profile described as representative for the Springer series.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, were areas of Amarillo and Tivoli soils.

Runoff is very slow on this Springer soil. The hazard of soil blowing is severe.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group B.

Springer loamy fine sand, 0 to 3 percent slopes, eroded (SH).—This soil is gently undulating. It is on uplands of the High Plains in areas of abandoned fields that were formerly used for dryfarmed crops.

The profile of this soil is similar to that described as representative for the series, but the surface layer is eroded.

About 55 percent of this mapping unit consists of low hummocks of accumulated loamy fine sand. The hummocks are 24 to 48 inches thick throughout the old fields, or 36 to 72 inches thick along the eastern and northern edges of the old fields. About 30 percent of the unit consists of areas where the surface layer has been blown away and the fine sandy loam subsoil has been exposed.

Included with this soil in mapping were areas of Tivoli, Brownfield, Amarillo, and Gomez soils. These included areas make up about 15 percent of the mapped acreage of this soil.

Runoff is slow on this Springer soil. The hazard of soil blowing is severe. Soil blowing is common in the more barren areas and less common in places where the soil is better stabilized by vegetation.

This soil is used for range and as wildlife habitat. Dryland capability subclass VIIe; Sand Hills range site; wildlife habitat group B.

Springer loamy fine sand, 3 to 9 percent slopes (SK).—This soil is undulating to gently rolling. It is on uplands of the High Plains.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown loamy fine sand about 14 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Amarillo loamy fine sand. Also included, and making up about 5 percent of the mapped acreage of this soil, were areas of Tivoli, Bascom, and Potter soils.

Runoff is slow to medium on this Springer soil. The hazard of soil blowing is severe, and the hazard of water erosion is slight to moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Deep Sand range site: wildlife habitat group B.

Springer fine sandy loam, 0 to 3 percent slopes (SM).—This soil is level to nearly level. It is on uplands of the High Plains in the northeastern part of the Tucumcari Area.

The profile of this soil is similar to that described as representative for the series, but the surface layer is reddish-brown fine sandy loam about 10 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Amarillo fine sandy loam. Also included, and making up about 5 percent of the mapped acreage of this soil, were areas of Ima, Bascom, and Potter soils.

Runoff is slow on this Springer soil. The hazard of soil blowing is moderate.

This soil is used for range, as wildlife habitat, and for dryfarmed crops. Dryland capability unit IVe–5; Deep Sand range site; wildlife habitat group A.

Springer fine sandy loam, 3 to 9 percent slopes (SN).—This soil is gently sloping to moderately sloping. It is on uplands of the High Plains.

The profile of this soil is similar to that described as representative for the series, but the surface layer is brown fine sandy loam about 8 inches thick. Included in mapping were small tracts of Springer fine sandy loam, 0 to 3 percent slopes, and of Ima soils.

Runoff is medium on this Springer soil. The hazard of erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Deep Sand range site; wildlife habitat group A.

Tivoli Series

The Tivoli series consists of deep, excessively drained soils that formed in wind-deposited, sandy sediment on sand hills. Slopes are 3 to 25 percent. The vegetation is tall grassees, sand sagebrush, skunkbush sumac, queensdelight, and wild plum. Elevation ranges from 4,000 to 4,800 feet. The average annual preciptation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Springer and Brownfield series.

In a representative profile the surface layer is light-brown fine sand about 6 inches thick. The substratum to a depth of 60 inches or more is reddish-yellow and pink fine sand. The soil is noncalcareous throughout the profile.

Permeability is rapid in the Tivoli soils. Available water holding capacity is 3 to 4 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and as wildlife habitat. Some areas are used for recreation.

Representative profile of Tivoli fine sand, 5 miles northeast of Logan on U.S. Highway 54, southeast three-fourths mile and northeast one-fourth mile to dunes in SW¼NE¼SE¼ sec. 21, T. 14 N., R. 34 E.:

A1—0 to 6 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 4/4) when moist; single grain; loose when dry and when moist, nonsticky and nonplastic when wet; many fine and medium roots; common fine interstitial pores; organic staining on about 50 percent of sand grains; noncalcareous; neutral (pH 7.2); clear, smooth boundary. 6 to 12 inches thick.

C1—6 to 48 inches, reddish-yellow (7.5YR 8/6) fine sand, (7.5YR 7/6) when moist; single grain; loose when

dry and when moist; nonsticky and nonplastic when wet; few fine roots; common fine interstitial pores; noncalcareous; neutral (pH 7.2); diffuse, smooth boundary. 36 to 48 inches thick.

C2—48 to 60 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) when moist; single grain; loose when dry and when moist; nonsticky and nonplastic when wet; common fine interstitial pores; noncalcareous; mildly alkaline (pH 7.6).

In the A horizon hue ranges from 5YR through 10YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma is 3 or 4. This horizon is fine sand or loamy fine sand.

Tivoli fine sand (3 to 25 percent slopes) (TF).—This soil is undulating to hilly. It is on sand hills in the northeastern part of the Tucumcari Area.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Springer and Brownfield soils and of Dune land.

Runoff is very slow to slow on this Tivoli soil. The hazard of soil blowing is severe.

This soil is used for range, as wildlife habitat, and for recreation. Dryland capability subclass VIIe; Sand Hills range site; wildlife habitat group B.

Toyah Series

The Toyah series consists of deep, well-drained soils that formed in mixed alluvium on alluvial fans. Slopes are 0 to 3 percent. The vegetation is mixed mid and short grasses, yucca, and mesquite. Elevation ranges from 4,200 to 4,600 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Bascon, Olton, and Kinkead series.

In a representative profile the surface layer is dark grayish-brown loam about 8 inches thick (Fig. 10). Underlying this is brown sandy clay loam and clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is reddish-yellow clay loam with distinct pink masses of lime. The soil is noncalcareous to a depth of 20 inches.

Permeability is moderate in the Toyah soils. Available water holding capacity is 10 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and watershed, as wildlife habitat, and for irrigated and dryfarmed crops.

Representative profile of Toyah loam, 0 to 3 percent slopes, NW¼SE¼NE¼ sec. 22, T. 16 N., R. 36 E.:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine vesicular and few fine tubular pores; noncalcareous; moderately alkaline (pH 8.2); gradual, smooth boundary. 6 to 10 inches thick.

C1—8 to 20 inches, brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) when moist; weak, fine, prismatic structure; hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine tubular pores; some rounded igneous gravel; noncalcareous; moderately alkaline (pH 8.2); gradual, wavy boundary. 10 to 14 inches thick.

C2—20 to 27 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; weak, fine, prismatic structure that parts to weak, fine, subangular blocky; hard, firm when moist, sticky and plastic when wet; common roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2); diffuse, wavy boundary. 4 to 10 inches thick.

C3ca—27 to 60 inches, reddish-yellow (7.5YR 7/6) clay loam; common medium, distinct, pink (7.5YR 8/4) masses of lime, reddish yellow (7.5YR 6/6) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2).

In the A horizon hue ranges from 7.5YR through 10YR, and value is 3 or 4 when dry. Chroma is 2 or 3 when moist.

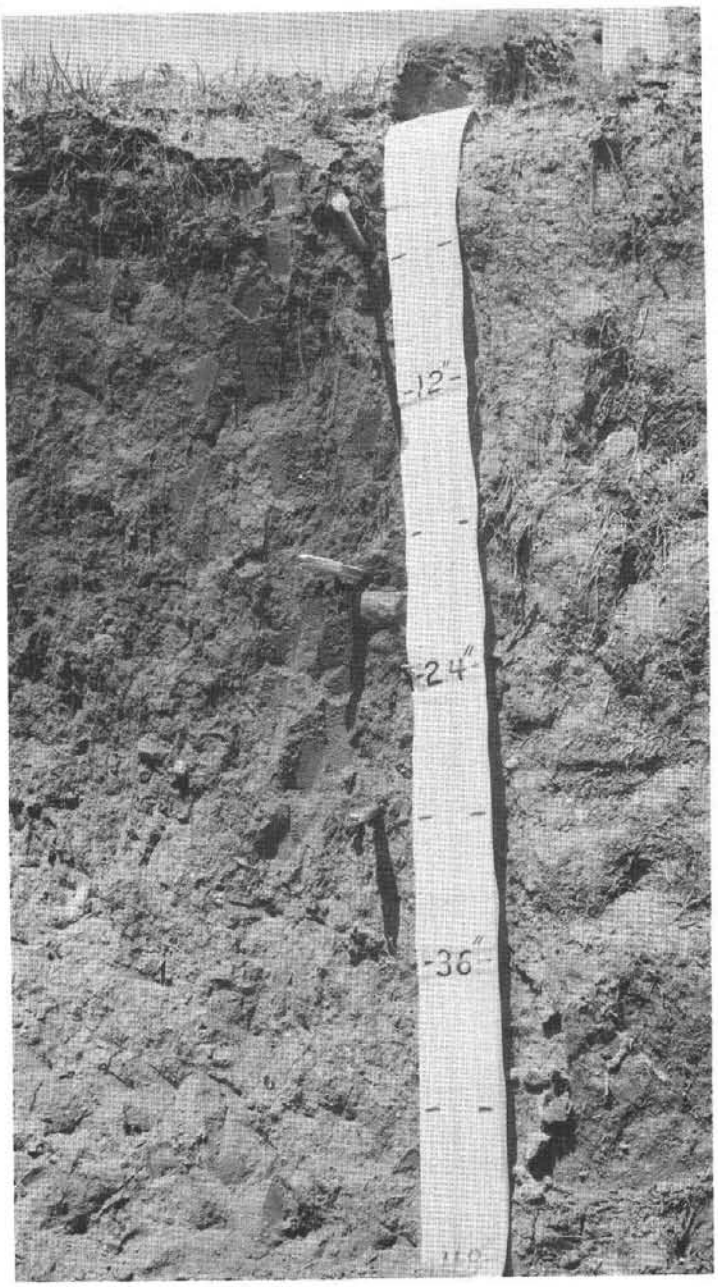

Figure 10.—**Profile of Toyah loam.**

Toyah loam, 0 to 3 percent slopes (Th).—This soil is level to nearly level. It is on alluvial fans and bottoms.

The profile of this soil is similar to that described as representative for the series, but the surface layer is dark-brown loam about 10 inches thick.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, were areas of Redona and Tucumcari soils.

Runoff is medium on this Toyah soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe–8; dryland capability unit IIIec–1; Loamy range site; wildlife habitat group A.

Toyah loam, 0 to 3 percent slopes (TK).—This soil is level to nearly level. It is on alluvial fans and bottoms.

This soil has the profile described as representative for the Toyah series.

Included with this soil in mapping, and making up less than 15 percent of the mapped acreage, were small areas of Kinkead, San Jose, Amarillo, and Bascom soils.

Runoff is medium on this Toyah soil. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is used for range, as wildlife habitat, and for watershed. A limited acreage is in dryfarmed crops. Dryland capability unit IIIec–1; Loamy range site; wildlife habitat group A.

Tucumcari Series

The Tucumcari series consists of deep, well-drained soils that formed in fine-textured alluvium derived from red-bed siltstone, shale, and sandstone. They are on alluvial fans and valley-filling slopes. Slopes are 0 to 3 percent. The vegetation is mostly mid and short grasses, mesquite, and cholla cactus. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 13 to 16 inches, and the average annual air temperature is 57° to 60° F. The frost-free season is 180 to 195 days. Associated soils are in the Kinkead, Montoya, Lacita, Quay, and Redona series.

In a representative profile the surface layer is reddish-brown clay loam about 8 inches thick. The subsoil is reddish-brown heavy clay loam and heavy silty clay loam about 41 inches thick. The substratum is reddish-brown silty clay loam. The soil is strongly calcareous throughout the profile.

Permeability is moderately slow in the Tucumcari soils. Available water holding capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

The Tucumcari soils are used for range, as wildlife habitat, for watershed, and for irrigated crops.

Representative profile of Tucumcari clay loam, 0 to 3 percent slopes, in Quay County, 800 feet south and 800 feet west of stock tank, SE¼SW¼ sec. 26, T. 8 N., R. 28 E.:

A1—0 to 8 inches, reddish-brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine vesicular pores; strongly calcareous; mildly alkaline (pH 7.6); clear, smooth boundary, 4 to 10 inches thick.

B1—8 to 16 inches, reddish-brown (2.5YR 5/4) heavy clay loam, (2.5YR 4/4) when moist; moderate, coarse, subangular blocky structure; very hard, firm when moist, slightly sticky and plastic when wet; common fine roots; common fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2); gradual, smooth boundary. 6 to 10 inches thick.

B2t—16 to 30 inches, reddish-brown (2.5YR 5/4) heavy clay loam, (2.5YR 4/4) when moist; moderate, coarse, subangular blocky structure; very hard, firm when moist, slightly sticky and plastic when wet; common fine roots; common fine tubular pores; thin continuous clay films; strongly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 14 to 20 inches thick.

B3tca—30 to 49 inches, reddish-brown (2.5YR 5/4) heavy silty clay loam, (2.5YR 4/4) when moist; moderate, medium, subangular blocky structure; very hard, firm when moist, slightly sticky and plastic when wet; few fine roots; common fine tubular pores; thin continuous clay films; distinct, common threads of lime; strongly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary. 12 to 20 inches thick.

C—49 to 60 inches, reddish-brown (2.5YR 5/4) silty clay loam, (2.5YR 4/4) when moist; massive; hard, firm when moist, slightly sticky and plastic when wet; few fine roots; few fine tubular pores; strongly calcareous; moderately alkaline (pH 8.2).

The solum is generally calcareous throughout, and threads or nodules of lime are few to common in the lower part of the B horizon. In the A horizon hue ranges from 5YR to 7.5YR, and value is 3 or 4 when moist. In the B2t and B3tca horizons hue ranges from 2.5YR to 5YR, and value is 5 or 6 when dry. Chroma ranges from 4 through 6.

Tucumcari clay loam, 0 to 1 percent slopes (Tm).—This soil is level. It is on slightly concave alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is 6 inches thick, and the subsoil is light reddish brown. Included in mapping were small areas of Redona and Montoya soils.

Runoff is medium on this Tucumcari soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIe–7; dryland capability subclass VIe; Clayey range site; wildlife habitat group D.

Tucumcari clay loam, 0 to 3 percent slopes (TN).—This soil is level to nearly level. It is on alluvial fans and valley-filling slopes.

This soil has the profile described as representative for the Tucumcari series. Included in mapping were areas of Montoya, Redona, and Lacita soils.

Runoff is medium on this Tucumcari soil. The hazard of erosion is moderate.

This soil is used for range, as wildlife habitat, and for watershed. Dryland capability subclass VIe; Clayey range site; wildlife habitat group D.

Tucumcari clay loam, 1 to 3 percent slopes (To).—This soil is nearly level. It is on upland alluvial fans.

The profile of this soil is similar to that described as representative for the series, but the surface layer is about 6 inches thick, and the subsoil is light reddish brown. Included in mapping were small areas of Redona, Lacita, and Montoya soils.

Runoff is medium on this Tucumcari soil. The hazard of erosion is moderate.

This soil is used for irrigated crops and range, as wildlife habitat, and for watershed. Irrigated capability unit IIIe–12; dryland capability subclass VIe; Clayey range site; wildlife habitat group D.

Use and Management of the Soils

In this section the capability classification system used by the Soil Conservation Service is explained. Then the management of irrigated capability units and dryland capability subclasses and units is discussed. Information on yields of the principal irrigated and dryfarmed crops under a high level of management is given.

This section also discusses the use of the soils for range, woodland and windbreaks, wildlife, engineering, and community and recreational development.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (No soils in the Tucumcari Area are in class I.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife. (No soils in the Tucumcari Area are in class V.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry. For some soils, climate and one of the other kinds of limitation have about equal importance, and the subclass symbol shows both kinds; IIIec is an example.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability subclasses and units in the Tucumcari Area are described, and suggestions for use and management of the soils are given. Management for both irrigated and dryfarmed soils in the capability classes II, III, and IV is discussed at the capability unit level. However, management for dryfarmed soils and land types in the capability classes VI, VII, and VIII is not discussed at the capability unit level because these soils and land types are used mostly for range, as wildlife habitat, and for recreation. Thus, these soils and land types are more broadly discussed at the capability subclass level in this subsection, and specific use and management information appears in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife."

Capability units are generally identified by numbers assigned locally and are part of a statewide system. Not all the units in this system are represented in the Tucumcari Area; consequently, the capability units described in this survey are not numbered consecutively.

Management of irrigated soils by capability units

In this subsection the soils of capability classes II, III, and IV are placed in irrigated capability units, and use and management that applies to each unit is discussed. All of the irrigated soils are in the part of the survey area mapped as high intensity.

Some general practices of management apply to the soils in all of the capability units. They are the conservation of moisture through efficient use of irrigation water, the control of erosion, and the maintenance of productivity.

The practices are accomplished mostly by applying water in the right amount at the proper time, using a conservation cropping system, and adding fertilizer according to soil tests. These measures can be taken singly or in combination, depending on the availability of water, the slope, and the kind of soil. Following is a more detailed discussion of some of the factors involved.

Irrigation generally is most efficient if the available water holding capacity of the soil and the amount of water needed to refill the root zone to field capacity are known. The soils in an area can differ markedly in this respect. In this survey area, for example, Tucumcari soils have a high available water holding capacity, but Los Tanos soils have a very low available water holding capacity. Whenever possible, crops should be irrigated before all of the available moisture is used. This watering, sometimes called a refill irrigation, is the inches of water needed to bring the soil to field capacity when a rapidly growing crop such as alfalfa needs irrigating.

The conservation cropping system for irrigated land depends on such factors as the kind of soil, the farmer's needs, the possibility of plant diseases, and the availability of markets. Crops such as alfalfa, cotton, and grain sorghum can be grown on soils when irrigated that otherwise would not be suitable for growing crops. In most years more residue can be produced and more crops can be grown for cover and for green manure on soils that are irrigated. A more flexible cropping system generally is possible on soils that are least subject to erosion, because when irrigated, these soils are suited to a wider range of crops. Better soil-improvement and fertility programs are also possible on irrigated soils. The most practical way to maintain or improve fertility and to increase productivity is to return large amounts of residue to the soil.

The amount and kind of fertilizer used should be based on research, soil analysis, past cropping history, past fertilization history, and production goals of each field. If unsubstantiated, recommendations for one field can easily be unsuitable for another. Soil tests indicate that irrigated soils in the Tucumcari Area are low in organic matter, nitrogen, and phosphorus. Representatives of the Soil Conservation Service and county agricultural agents can assist in the planning of fertilization programs.

Both mechanical and chemical means are suitable, and necessary, to control annual and perennial weeds on irrigated soils in the Tucumcari Area.

In the following descriptions of capability units, the soil series represented in each unit are mentioned, but this does not necessarily mean that all soils of the series are in the unit. To determine the capability unit in which any soil has been placed, refer to the soil in the section "Descriptions of the Soils," or to the "Guide to Mapping Units" at the back of this survey.

IRRIGATED CAPABILITY UNIT IIe-1

This unit consists of well-drained soils of the La Lande, Quay, Redona, and San Jose series. The surface layer is loam, and the subsoil is clay loam or sandy clay loam. These soils formed in alluvium, and they are on alluvial fans, terraces, benches, and valley sides. Slopes are 0 to 1 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate to moderately rapid in the soils of this unit. Runoff is slow to medium, and the hazard of erosion is moderate. Available water holding capacity is 5 to 11 inches. Rooting depth is 24 to 60 inches or more.

These soils are used for irrigated crops and range, and as wildlife habitat. They are suitable for growing such adapted irrigated crops as alfalfa, grain sorghum, small grain, cotton, and vegetables.

If the soils of this unit are properly managed, the hazard of soil blowing is slight. Growing crops 1 year in 3 that leave a large amount of residue on the surface, applying a mulch of suitable residue, and growing cover crops are ways of controlling water erosion and soil blowing.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa and truck crops need applications of a fertilizer that contains phosphorus. Some crops grown on Quay soils are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

These soils are better suited to surface than to sprinkler irrigation. For efficient and uniform application of irrigation water, properly prepared areas and a properly designed irrigation system are needed. In places the moderate depth of the lime zone in Quay soils restricts the depth of cuts that can be made during leveling operations.

IRRIGATED CAPABILITY UNIT IIe-3

This unit consists of well-drained soils of the La Lande, Quay, and Redona series. The surface layer is fine sandy loam, and the subsoil is sandy clay loam and clay loam. These soils formed in alluvium derived from mixed sources and red-bed material. They are smooth and level. Slopes are 0 to 1 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this unit. Runoff is slow, and the hazard of soil blowing is moderate. Available water holding capacity is 5 to 11 inches. Effective rooting depth is about 60 inches, except in Quay soils where a high content of lime limits root penetration below a depth of 20 to 36 inches.

These soils are used for irrigated crops and range and as wildlife habitat. They are suitable for growing sorghum, small grain, alfalfa, cotton, and vegetables.

Growing crops 1 year in 3 that leave a large amount of residue on the surface or that improve the soil material, applying a mulch of suitable residue, and growing

cover crops are ways of controlling soil blowing and maintaining good soil tilth. In extreme cases that result from a lack of the foregoing practices, emergency tillage helps reduce the effects of soil blowing.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorous. Some crops grown on Quay soils are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

These soils are suited to either surface or sprinkler irrigation.

IRRIGATED CAPABILITY UNIT IIe–7

This unit consists of well-drained soils of the Lacita and Tucumcari series. The surface layer is silt loam or clay loam, and the subsoil is silt loam to silty clay loam and heavy clay loam. These soils formed in stratified alluvium. They are smooth and level. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is moderately slow in the soils of this unit. Runoff is medium, and the hazard of water erosion is moderate. Available water holding capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and range and as wildlife habitat. They are suitable for growing alfalfa, sorghum, small grain, and cotton.

If the soils of this unit are properly managed, the hazard of soil blowing is slight. Growing crops 1 year in 3 that leave a large amount of residue on the surface, applying a mulch of suitable residue, growing cover crops, and growing crops that improve the soil are ways of controlling water erosion and soil blowing and maintaining or improving soil tilth. These soils are difficult to keep in good tilth because they seal over readily when wet. They are also susceptible to soil piping.

Most crops grown on this soil require applications of a fertilizer that contains nitrogen. Alfalfa and vegetables need applications of a fertilizer that contains phosphorus.

These soils are better suited to surface than to sprinkler irrigation. For efficient and uniform application of irrigation water, properly prepared areas and a properly designed irrigation system are needed. Care must be exercised in irrigating to prevent scalding and drowning of crops.

IRRIGATED CAPABILITY UNIT IIe–8

This unit consists of deep, well-drained soils of the La Lande, Redona, and Toyah series. The surface layer is loam, and the underlying layer is clay loam or sandy clay loam. These soils formed in mixed alluvium and are smooth and nearly level. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this unit. Runoff is medium, and the hazard of water erosion is moderate. Available water holding capacity is 9.5 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are suitable for growing all irrigated crops adapted to the Area. Alfalfa, irrigated pasture crops, small grain, sorghum, and vegetables are the major crops grown. Cotton is grown less extensively.

Growing crops 1 year in 3 that leave a large amount of residue on the surface or that improve the soil material helps to control water erosion and to maintain good soil tilth.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus.

These soils are better suited to surface than to sprinkler irrigation. Graded or leveled borders are needed in places. Reshaping of the surface to a planned grade is needed in places to control irrigation water.

IRRIGATED CAPABILITY UNIT IIs–1

Only Kinkead clay loam, 0 to 1 percent slopes, is in this unit. It is well drained. The surface layer is clay loam, and the subsoil is heavy silty clay loam, and clay. This soil formed in medium-textured to fine-textured alluvium on alluvial fans. Slopes are 0 to 1 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 175 to 195 days.

Permeability is slow in this soil. Runoff is medium. The hazards of soil blowing and water erosion are slight. Available water holding capacity is 11 to 12 inches. Effective rooting depth is 60 inches or more.

This soil is suitable for growing such adapted irrigated crops as alfalfa, grain and forage sorghum, cotton, and vegetables. It is also suitable for irrigated pasture.

If this soil is properly managed, the hazard of soil blowing is slight. Growing crops 1 year in 3 that leave a large amount of residue on the surface or that improve the soil material, applying a mulch of suitable residue, and growing cover crops are ways of maintaining or improving soil tilth. This soil is difficult to keep in good tilth. It becomes cloddy when worked, and it cracks when dry and seals over when wet. Proper use of crop residue also helps to keep the subsoil open to roots, and it aids the movement of water and air through the subsoil. In places chiseling is needed to break open compacted layers in the subsoil.

Most crops grown on this soil require applications of a fertilizer that contains nitrogen. Alfalfa and vegetables need applications of a fertilizer that contains phosphorous.

This soil is better suited to surface than to sprinkler irrigation. Care must be exercised in irrigating to prevent scalding and drowning of crops.

IRRIGATED CAPABILITY UNIT IIIe–4

This unit consists of well-drained soils of the Canez, Ima, La Lande, Quay, and Redona series, and of the Canez variant. The surface layer is fine sandy loam or sandy loam, and the subsoil is sandy clay loam or clay loam to fine sandy loam. These soils formed in old alluvium on alluvial fans. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate to moderately rapid in the soils of this unit. Runoff is slow. The hazards of water erosion and soil blowing are moderate. Available water holding capacity is 5 to 11 inches. Effective rooting depth is 24 to 60 inches.

These soils are used for range, as wildlife habitat, and for irrigated crops. They are suitable for growing such

adapted irrigated crops as alfalfa, cotton, grain sorghum, small grain, and vegetables. They are also suitable for irrigated pasture.

Growing crops every other year that leave a large amount of residue on the surface or that improve the soil material and applying a mulch of suitable residue are ways of controlling water erosion and soil blowing and maintaining good soil tilth. If the surface is leveled and a level system of irrigation is established, growing crops 2 years in 4 that leave a large amount of residue on the surface or that improve the soil material is satisfactory.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus. Some crops, especially sorghum grown on Quay soils, are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

These soils are suited to either surface or sprinkler irrigation. Graded or leveled borders are needed in places. Reshaping of the surface to a planned grade is needed in places to control irrigation water. In places the moderate depth of the lime zone in Quay soils restricts the depth of cuts that can be made during leveling operations.

IRRIGATED CAPABILITY UNIT IIIe–6

This unit consists of well-drained, calcareous soils of the Quay series. The surface layer is loam, and the subsoil is clay loam. The substratum has a high content of lime. These soils formed in alluvium derived from redbed material. They are on alluvial fans. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this unit. Runoff is slow to medium, and the hazard of water erosion is moderate. Available water holding capacity is 5 to 6 inches. Effective rooting depth is 22 to 38 inches.

These soils are used for range, as wildlife habitat, and for irrigated crops. They are suitable for such adapted irrigated crops as grain and forage sorghum, alfalfa, small grain, cotton, and vegetables. They are also suitable for irrigated pasture.

Growing crops 2 years in 4 that leave a large amount of residue on the surface or that improve the soil helps to control water erosion and to maintain good soil tilth.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus. Some crops grown on these soils, especially sorghum, are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

If these soils are to be irrigated by the sprinkler method, smooth grading of the surface is helpful. In places the moderate depth of the strong lime zone and the moderate depth to sandstone restrict the depth of cuts that can be made during leveling operations. In areas where lime has been exposed by leveling operations, applications of barnyard manure are helpful. Unless irrigation water is properly managed, a perched water table is likely to form in the Quay loam, sandstone substratum soils.

IRRIGATED CAPABILITY UNIT IIIe–10

Only Redona loamy fine sand, 0 to 3 percent slopes, is in this unit. It is well drained. The surface layer is loamy fine sand, and the subsoil is sandy clay loam and clay loam. This soil formed in old alluvium on alluvial fans and valley sides. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in this soil. Runoff is very slow to slow. The hazard of soil blowing is severe. Available water holding capacity is 9.5 to 11 inches. Rooting depth is 60 inches or more.

This soil is used for irrigated crops and range and as wildlife habitat. It is suitable for growing such adapted irrigated crops as alfalfa, cotton, and grain and forage sorghum. It is also suitable for irrigated pasture.

Growing crops 2 years in 4 that leave a large amount of residue on the surface helps to control soil blowing. In extreme cases that result because of a lack of this practice, emergency tillage helps reduce the effects of soil blowing. Deep breaking of the soil is effective as a temporary control measure for soil blowing.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus.

This soil is suited to sprinkler irrigation. Areas in this unit require a minimum of preparation for this type of irrigation.

IRRIGATED CAPABILITY UNIT IIIe–12

This unit consists of well-drained soils of the Kinkead, Lacita, and Tucumcari series. The surface layer is clay loam or silt loam, and the subsoil is heavy silt loam to clay. These soils formed in medium-textured to fine-textured alluvium. Slopes are 1 to 3 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 175 to 195 days.

Permeability is slow to moderately slow in the soils of this unit. Runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Available water holding capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and range and as wildlife habitat. Alfalfa and sorghum are the major irrigated crops grown. Wheat and cotton are grown less extensively.

Growing crops 2 years in 4 that leave a large amount of residue on the surface or that improve the soil material and applying a mulch of suitable residue are ways of controlling water erosion and maintaining or improving soil tilth. These soils are difficult to keep in good tilth. Growing deep-rooted crops and maintaining the content of organic matter at a high level are ways to help the movement of air and water through these soils. In places chiseling is needed to break open compacted layers in the subsoil.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus.

These soils are better suited to surface than to sprinkler irrigation. Graded or leveled borders are needed in places where soils are more sloping.

IRRIGATED CAPABILITY UNIT IVe-1

This unit consists of moderately deep, well-drained soils of the Los Tanos and Quay series. The surface layer is loam or sandy loam, and the subsoil is sandy loam or clay loam. Sandstone or shale is at a depth ranging from 20 to 35 inches. These soils formed in alluvium derived from red-bed material weathered from sandstone. Slopes are 1 to 5 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate to moderately rapid in the soils of this unit. Runoff is slow to medium. The hazard of water erosion and soil blowing are moderate. Available water holding capacity is 2.5 to 5 inches. Effective rooting depth is 20 to 30 inches.

These soils are used for range, as wildlife habitat, and for irrigated crops. They are most suitable for growing irrigated pasture crops, small grain, and sorghum.

Growing crops 2 years in 3 that leave a large amount of residue on the surface or plowing under green-manure crops helps to control water erosion and soil blowing, and to maintain or improve soil tilth.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen and phosphorus. Some crops grown on these soils are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

If these soils are to be irrigated by the sprinkler method, smooth grading or leveling of the surface and farming on the contour are helpful. Sandstone or shale at a depth of 20 to 35 inches limits the depth of cuts that can be made during leveling operations.

IRRIGATED CAPABILITY UNIT IVe-8

This unit consists of well-drained soils of the Canez, Gomez, and Redona series. The surface layer is loamy fine sand, and the subsoil is sandy clay loam, clay loam, or light sandy loam. These soils formed in old, mixed, wind-worked alluvium. They are on uplands. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate to moderately rapid in the soils of this unit. Runoff is very slow to slow. The hazard of soil blowing is severe. Available water holding capacity is 3.5 to 9.5 inches. Effective rooting depth is 20 to 60 inches or more.

These soils are used for irrigated crops and range and as wildlife habitat. They are suitable for growing such adapted irrigated crops as alfalfa and grain and forage sorghum. They are also suitable for irrigated pasture.

Growing closely spaced crops each year that leave a large amount of residue on the surface, or growing crops 2 years in 3 that improve the soil, helps to control soil blowing. In extreme cases where these practices have not been applied, or have been applied inadequately, emergency tillage, such as deep listing, helps reduce the effects of soil blowing.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen and phosphorus. Some crops grown on Gomez soils are susceptible to chlorosis because of iron deficiency. Adding iron sulfate, acid-forming amendments, or iron chelates helps to control this condition.

These soils are better suited to sprinkler than to surface irrigation. Smooth grading of the surface is helpful. If these soils are to be irrigated by the surface method, graded or leveled borders are needed in places where the soils are more sloping. A high-lime zone at a depth of 20 to 40 inches restricts the depth of cuts that can be made during leveling operations. In areas where lime has been exposed by leveling operations, applications of barnyard manure are helpful. The severe hazard of soil blowing also hampers leveling operations.

IRRIGATED CAPABILITY UNIT IVe-13

This unit consists of well-drained soils of the Canez, Ima, La Lande, Quay, and Redona series, and of the Canez variant. The surface layer is loam to loamy fine sand, and the subsoil is clay loam, sandy clay loam, loam, or fine sandy loam. These soils formed in alluvium. They are on uplands in areas where topography is smooth. Slopes range from 3 to 9 percent, but are mostly 3 to 5 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate to moderately rapid in the soils of this unit. Runoff is slow to rapid. The hazards of water erosion and soil blowing are moderate to severe. Available water holding capacity is 5 to 11 inches. Effective rooting depth is 20 to 60 inches.

These soils are used for range, as wildlife habitat, and for irrigated crops. They are suitable for irrigated pasture and for such irrigated crops as alfalfa and grain and forage sorghum.

Growing crops each year that leave a large amount of residue on the surface or that improve the soil material helps to control soil blowing and water erosion and to maintain good soil tilth. In addition, stubble-mulch tillage slows surface runoff, increases the water intake rate, and helps to reduce the loss of soil nutrients in these soils.

Most crops grown on the soils of this unit require applications of a fertilizer that contains nitrogen. Alfalfa needs applications of a fertilizer that contains phosphorus.

Where these soils are to be irrigated by the surface method, they need to be bench leveled. Where they are to be irrigated by the sprinkler method, smooth grading is sufficient.

IRRIGATED CAPABILITY UNIT IVs-3

This unit consists of well-drained soils of the Montoya series. The surface layer is clay loam, and the subsoil is clay. These soils formed in fine-textured alluvium derived from red-bed shale. They are smooth and level to nearly level. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is about 180 to 195 days.

Permeability is very slow in the soils of this unit. Runoff is medium. The hazard of erosion is slight to moderate. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and range, and as wildlife habitat. They are suitable for irrigated pas-

ture and for such irrigated crops as alfalfa, grain or forage sorghum, and cotton.

Growing crops 2 years in 3 that leave a large amount of residue on the surface or that improve the soil material helps to control erosion and to maintain or improve soil tilth. These soils are difficult to keep in good tilth. They become cloddy when worked, and then crack when dry and seal over when wet. In addition, these soils have a very slow intake rate after 1 hour of wetting. Including deep-rooted crops in the cropping system helps keep the clay subsoils open. These soils are susceptible to accumulation of soluble salts.

Most crops grown on the soils of this unit need applications of a fertilizer that contains nitrogen and phosphorus.

For efficient and uniform application of irrigation water, properly prepared areas and a properly designed irrigation system are needed. The system used on these fine-textured soils should allow for maximum benefit from the initial high intake rate. Care must be exercised in irrigating to prevent scalding or drowning of crops. In irrigated areas soils need to be protected against potential damage by runoff water.

Management of dryland soils by capability subclasses and units

In this subsection the soils of capability classes III and IV are placed in dryland capability units and the soils of capability classes VI, VII, and VIII are placed in dryland capability subclasses. Most of these soils are in the part of the survey area mapped as medium intensity. Use and management information applying to the soils in each capability unit is given. For management of soils in the capability subclasses, refer to the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife."

Some general practices of management apply to the soils in all of the dryland capability units. The two major ones are the conservation of moisture and the control of water erosion and soil blowing. These practices are necessary because of low and irregular rainfall, torrential showers, blowing snow, hail, early-spring winds, wide fluctuations in yearly temperatures, slope variations, and wide variations in texture of surface and subsoil layers. Fertility is not a major restriction to crop yields on dryfarmed soils. The use of commercial fertilizers to increase production on these soils has not proven feasible. Lack of moisture is the greatest limiting factor of plant growth.

Stubble mulching, using crop residue, and farming and terracing on the contour help to conserve moisture and control erosion on these soils. A suitable cropping system, emergency tillage, and deep plowing also help to control erosion. These measures can be taken singly or in combination, depending on difficulties involved at a specific site, the slope, and the kind of soil. Following is a more detailed discussion of some of the factors involved.

Stubble-mulching and the use of crop residue are practices that are needed to protect dry cropland from erosion. Stubble mulching is particularly suitable for conserving both soil and moisture. It provides a protective cover that prevents wind from striking the soil surface directly, and it provides the organic material necessary to help stabilize soil aggregates in the surface layer. It also helps to control weeds and causes little disturbance to surface residue. A stubble mulch is also good for catching snow, and helps reduce blowing and drifting (fig. 11). Crop residue provides a protective cover for soils late in winter and early in spring. If dryland soils are plowed early in winter, this protective cover is destroyed. Maintaining crop residue through a critical period also helps to trap snow and increase storage of moisture.

Contour farming and terracing help conserve both soil and water. Contour farming, without terraces, is used only on moderately coarse textured and medium-textured soils that have fairly uniform slopes.

A cropping system for dryland soils is restricted by the few crops that are suitable under the prevailing climate. Broomcorn, millet, and grain sorghum are the principal dryfarmed crops; however, the cropping sequence varies widely among farm operators. Systems commonly in use where row crops are grown are: continuous sorghum for silage, bundle feed, or grain; and alternated sorghum and broomcorn. Some cropping systems include sudangrass, which is used for the grazing of livestock, for bundle feed, or for seed. Others include closely spaced sorghum or drilled small grain for grazing and for stubble mulching.

Emergency tillage is any mechanical operation, such as listing or chiseling, that roughens the soil surface to minimize the hazard of soil blowing. It is mostly used when the vegetation or crop residue is not adequate to

Figure 11.—Crop residue catches snow, reduces drifting.

control soil blowing, or when the soil itself is not cloddy enough or rough enough to resist erosion. Tillage methods vary according to texture of the soil and stability of clods. On sandy soils, such as Amarillo loamy fine sand, 0 to 3 percent slopes, emergency tillage is largely ineffective or, at best, is effective for only a short time.

Deep plowing to control soil blowing is effective only when the surface layer is moderately coarse textured or coarse textured, and when the subsoil is loam or sandy clay loam within plow depth. Amarillo loamy fine sand is an example. The depth of plowing should range from 14 to 26 inches. For good results about one-third of the furrow slice should be of the finer textured subsoil material. After a soil is deep plowed, crops that produce large amounts of residue can be grown to maintain stability. In some places deep plowing is useful for stabilizing the soil and for producing sufficient stubble cover to reseed fields to grass.

In the following descriptions of capability subclasses and units, the soil series represented in each are mentioned, but this does not necessarily mean that all soils of the series are in the subclass or unit. To determine the capability subclass or unit in which any soil has been placed, refer to the soil in the section "Descriptions of the Soils," or the "Guide to Mapping Units" at the back of this survey.

DRYLAND CAPABILITY UNIT IIIe-1

This unit consists of well-drained soils of the Amarillo series and of the Bascom variant. The surface layer is fine sandy loam, and the subsoil is sandy clay loam and heavy fine sandy loam. These soils formed in old, wind-reworked alluvium. They are on uplands in areas where topography is smooth. Slopes are 0 to 3 percent. The average annual precipitation is 14 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this unit. Runoff is slow, and the hazard of soil blowing is moderate. Available water holding capacity is 4 to 9.5 inches. Effective rooting depth is 20 to 60 inches.

These soils are used for range, as wildlife habitat, and for dryfarmed crops. Grain and forage sorghum and broomcorn are the major dryfarmed crops grown. Such small grains as barley, millet, and wheat are grown less extensively.

Growing crops 2 years in 4 that leave a large amount of residue on the surface helps to control soil blowing. In extreme cases, where such management is not practiced or is inadequately practiced, listing or some other form of emergency tillage helps to reduce the effects of soil blowing. In addition, contour farming and terracing where slopes are 1 to 3 percent help to reduce runoff and to conserve soil and moisture.

These soils are suited to both mechanical and chemical means of controlling annual and perennial weeds.

DRYLAND CAPABILITY UNIT IIIec-1

This unit consists of well-drained soils of the Olton and Toyah series, and of the Bascom variant. The surface layer is loam, and the subsoil is sandy clay loam to heavy clay loam. These soils formed in moderately fine textured alluvium modified in places by wind. Slopes are 0 to 3 percent. The average annual precipitation is 14 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderately slow to moderate in the soils of this unit. Runoff is slow to medium. The hazard of water erosion is moderate, and the hazard of soil blowing is moderate. Available water holding capacity is 4 to 11 inches. Effective rooting depth is 20 to 60 inches.

These soils are used for range and as wildlife habitat. A limited acreage is in dryfarmed crops. The adapted dryfarmed crops grown are small grain, broomcorn, and grain and forage sorghum.

Growing crops 2 years in 4 that leave a large amount of residue on the surface helps to control water erosion and soil blowing. In extreme cases, emergency tillage helps reduce the effects of soil blowing. In addition, stubble-mulch tillage helps to slow surface runoff, increase the rate of water intake, and reduce the loss of moisture, soil material, and nutrients. Contour farming and level terracing where slopes are more than 1 percent also help to reduce runoff and control erosion. Alternating wheat and fallow in the cropping system is more suitable than growing wheat continuously.

These soils are suited to both mechanical and chemical means of controlling annual and perennial weeds.

DRYLAND CAPABILITY UNIT IVe-1

This unit consists of well-drained soils of the Amarillo series. The surface layer is loamy fine sand, and the subsoil is sandy clay loam and heavy fine sandy loam. These soils formed in old alluvium. They are on uplands of the High Plains. Slopes are 0 to 3 percent. The average annual precipitation is 14 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this unit. Runoff is very slow. Unless these soils have an adequate vegetative cover, the hazard of soil blowing is severe. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is about 60 inches.

These soils are used for range and dryfarmed crops, and as wildlife habitat. The adapted dryfarmed crops grown are broomcorn and grain and forage sorghum.

Growing crops each year that leave large amounts of residue on the surface, and stubble-mulching fields where row crops are grown, are ways of helping to control soil blowing. Cross-wind tillage is also a helpful practice. Emergency tillage and deep plowing are effective as temporary measures for control of soil blowing (fig. 12).

These soils are suited to both mechanical and chemical means of controlling annual and perennial weeds.

DRYLAND CAPABILITY UNIT IVe-5

Only Springer fine sandy loam, 0 to 3 percent slopes, is in this unit. It is well drained. Both the surface layer and the subsoil are fine sandy loam. This soil formed in wind-worked alluvium on the High Plains. The average annual precipitation is 14 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderately rapid in this soil. Runoff is slow. Unless this soil has an adequate vegetative cover, the hazard of soil blowing is moderate to severe. Available water holding capacity is 5.5 to 6.5 inches. Effective rooting depth is 60 inches or more.

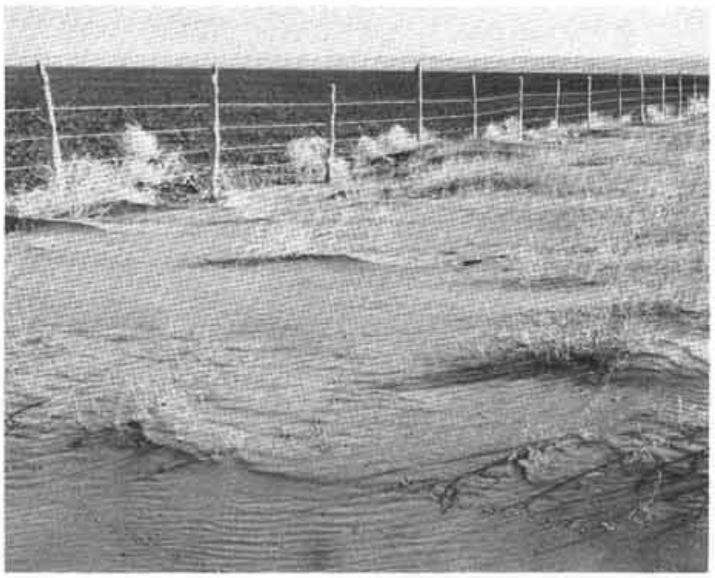

Figure 12.—Fence-line accumulation on Amarillo loamy fine sand, 0 to 3 percent slopes.

This soil is used for range and as wildlife habitat. A limited acreage is in dryfarmed crops. The adapted dryfarmed crops are broomcorn, grain and forage sorghum, and sudangrass.

Growing crops each year that leave a large amount of residue on the surface, contour farming, and terracing are ways of helping to control soil blowing. Cross-wind tillage is also a helpful practice. Emergency tillage is only partly effective as a temporary control measure for soil blowing, because the subsoil does not contain sufficient clay to form stable clods.

This soil is suited to both mechamical and chemical means of controlling annual and perennial weeds.

DRYLAND CAPABILITY SUBCLASS VIe

This subclass consists of well-drained soils of the Amarillo, Bascom, Brownfield, Canez, Gallegos, Gomez, Ima, Kinkead, Lacita, La Lande, Los Tanos, Potter, Quay, Redona, San Jon, San Jose, Sharvana, Springer, and Tucumcari series, and of the Canez variant. The surface layer ranges from clay loam to fine sand, and the subsoil ranges from clay to fractured cemented caliche. These soils formed mostly in alluvium and valley-filling alluvium. They are on alluvial fans, old terraces, and uplands. Slopes range from 0 to 25 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 175 to 195 days.

Permeability is moderately slow to moderately rapid in all the soils of this subclass, except in the Kinkead soils where it is slow. Unless these soils have an adequate vegetative cover, runoff is very slow to rapid and the hazard of erosion is mostly moderate to severe. Available water holding capacity ranges from 1 to 13 inches. Effective rooting depth ranges from 6 to 60 inches or more.

The soils of this subclass are generally not suited to dryland crops. Most of these soils are used for range and as wildlife habitat. Their use and management are given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife." Irrigation water is available in a few areas of these soils, and the soils are used and managed the same as adjacent irrigated soils.

DRYLAND CAPABILITY SUBCLASS VIew

This subclass consists of well-drained soils of the Montoya series. The surface layer is clay loam, and the subsoil is clay. These soils formed in fine-textured alluvium derived from red-bed shale. They are on channelled flood plains. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 16 inches, and the frost-free season is 180 to 195 days.

Permeability is very slow in the soils of this subclass. Runoff is medium to rapid. The hazard of erosion is moderate to severe. Additional water is received as runoff from surrounding upland soils. Available water holding capacity is 8 to 9.5 inches. Effective rooting depth is 60 inches.

These soils are used for range and as wildlife habitat. Their use and management are given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife."

DRYLAND CAPABILITY SUBCLASS VIIe

This subclass consists of well-drained or excessively drained, moderately to rapidly permeable soils of the Brownfield, Canez, Minneosa, Springer, and Tivoli series. Also in this subclass are areas of the land types Rough broken and stony land, hilly, and Rough broken and stony land, steep. The surface layer of the soils in this subclass is fine sand or loamy fine sand. It is underlain by fine sand to sandy clay loam. These soils formed in sandy wind-laid deposits or in wind-worked alluvium. They are on sloping uplands and drainageways of the High Plains. The land types formed in red-bed shale, clay, and interbedded sandstone bedrock. They are on breaks where slopes are very steep. Included with the land types are areas of soils that are very shallow to bedrock. Slopes are 0 to 75 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Runoff is very slow to slow on the soils of this subclass. The hazard of soil blowing is severe. On the land types and included soils, unless there is adequate vegetative cover, runoff is rapid and the hazard of water erosion is severe. Silt from higher areas is deposited on the soils in lower areas of this subclass in places. The Brownfield, Canez, and Springer soils have been damaged by soil blowing. Available water holding capacity is 0 to 9.5 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and as wildlife habitat. Their use and management are given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife."

DRYLAND CAPABILITY SUBCLASS VIIs

This subclass consists of well-drained soils of the Latom and Potter series and of areas of the land type Rock land. The soils are very shallow to shallow over sandstone or caliche. Many rock outcrops are present in places. These soils and the land type formed in material weathered from beds of sandstone, shale, and caliche. Slopes are 1 to 80 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is moderate in the soils of this subclass. Runoff is medium to rapid. Unless the soils have an adequate vegetative cover, the hazard of erosion is moderate to severe. Available water holding capacity is 0 to 2 inches. Effective rooting depth is 0 to 20 inches.

The soils in this subclass are used for range and as wildlife habitat. Their use and management are given in the sections "Use of the Soils for Range" and "Use of the Soils for Wildlife."

DRYLAND CAPABILITY SUBCLASS VIIIe

This subclass consists of the land types Dune land, Gullied land, and Gullied land, San Jon material. These land types formed from wind-shifted sand dunes and in alluvium derived from red-bed shale and sandstone. Vegetation is sparse or absent. Slopes are 0 to 9 percent; however, many of the gullies, which range from 2 to 30 feet in depth, have vertical walls. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is slow to very rapid in the soil material of the land types in this subclass. Runoff is slow to rapid. In places the hazard of water erosion is very severe. In other places the hazard of soil blowing is very severe.

Areas of the land types in this subclass are used as wildlife habitat, for watershed, and for recreation. Indian artifacts are found in places. These land types are not suited to windbreaks. Their use and management are given in the sections "Use of the Soils for Wildlife" and "Use of the Soils for Community and Recreational Development."

DRYLAND CAPABILITY SUBCLASS VIIIw

Only the land type Riverwash is in this subclass. It is mostly sand and gravel. This land type formed in alluvium from the Canadian River and its tributaries. The areas are subject to frequent overflow, deposition, and erosion. Vegetation is sparse or absent. Slopes are 0 to 3 percent. The average annual precipitation is 13 to 17 inches, and the frost-free season is 180 to 195 days.

Permeability is mostly rapid in the soil material of the land type in this subclass. Runoff is medium to rapid, and the hazard of erosion is severe.

Areas of the land type in this subclass are used for watershed and as wildlife habitat. They are also used as a source of sand and gravel. Their use and management are given in the section "Use of the Soils for Wildlife."

Estimated crop yields on irrigated and dryfarmed soil

Table 2 gives the estimated average acre yields of the principal crops grown on irrigated and dryfarmed soils in the Tucumcari Area. The estimated yields are based on reports of the New Mexico Agricultural Experiment Station, farmers, the county extension agent, and technicians of the Soil Conservation Service. Yields are for a high level of management.

The high level of management for irrigated soils includes planned cropping systems for soil improvement, balanced fertilization to meet the needs of crops grown, use of good seed, control of weeds, insects, and disease, and efficient use of irrigation water. It also includes measures for erosion control, drainage, and reducing content of toxic salts where needed.

The high management level for dryfarmed soils includes planned cropping systems for soil improvement, use of good seed, control of weeds, insects, and disease, and measures for erosion control.

Variations in the amount and distribution of rainfall and other hazards of climate cause crop failures. Consequently, yields shown in the table cannot be expected each year.

TABLE 2.—*Estimated acre yields of principal crops on irrigated and dryfarmed soils under a high level of management*

[Only the soils used to a significant extent for the specified crops are listed. Absence of yield indicates that the soil is generally not suitable or not used for the crop]

Soil	Irrigated crops				Dryfarmed crops			
	Cotton lint	Alfalfa	Grain sorghum	Wheat	Grain sorghum	Forage sorghum	Broom-corn	Wheat
	Lb	*Tons*	*Lb*	*Bu*	*Lb*	*Tons*	*Lb*	*Bu*
Amarillo loamy fine sand, 0 to 3 percent slopes					1, 200	1. 5	400	
Amarillo fine sandy loam, 0 to 3 percent slopes					1, 800	2. 0	450	12
Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes					1, 800	2. 0	450	13
Bascom loam, nongravelly variant, 0 to 3 percent slopes					1, 200	1. 5	300	15
Canez loamy fine sand, 0 to 3 percent slopes		5. 3	4, 100					
Canez loamy fine sand, 3 to 9 percent slopes		4. 5	3, 900					
Canez fine sandy loam, 0 to 3 percent slopes	700	6. 0	5, 500	35				
Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes	650	6. 0	5, 200	30				
Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes		4. 8	3, 900					

TABLE 2.—*Estimated acre yields of principal crops on irrigated and dryfarmed soils under a high level of management*—Con.

Soil	Irrigated crops				Dryfarmed crops			
	Cotton lint	Alfalfa	Grain sorghum	Wheat	Grain sorghum	Forage sorghum	Broom-corn	Wheat
	Lb	*Tons*	*Lb*	*Bu*	*Lb*	*Tons*	*Lb*	*Bu*
Gomez loamy fine sand, 0 to 3 percent slopes			4, 000					
Ima sandy loam, 1 to 3 percent slopes	650	5. 5	4, 900	30				
Ima sandy loam, 3 to 5 percent slopes		4. 5	3, 900					
Kinkead clay loam, 0 to 1 percent slopes	750	6. 0	7, 000	65				
Kinkead clay loam, 1 to 3 percent slopes	550	5. 5	5, 300	50				
Lacita silt loam, 0 to 1 percent slopes	725	6. 5	7, 000	60				
Lacita silt loam, 1 to 3 percent slopes	550	5. 0	5, 100	45				
La Lande fine sandy loam, 0 to 1 percent slopes	800	7. 0	7, 000	50				
La Lande fine sandy loam, 1 to 3 percent slopes	600	6. 0	6, 000	40				
La Lande loam, 0 to 1 percent slopes	900	7. 5	7, 500	65				
La Lande loam, 1 to 3 percent slopes	650	6. 0	6, 000	50				
La Lande loam, 3 to 5 percent slopes		4. 5	4, 600					
Los Tanos sandy loam, 1 to 5 percent slopes			4, 000					
Montoya clay loam, 0 to 1 percent slopes	400	4. 5	3, 800	40				
Montoya clay loam, 1 to 3 percent slopes	375	4. 0	3, 400	35				
Olton loam, 0 to 3 percent slopes					1, 600	2. 0	300	15
Quay fine sandy loam, 0 to 1 percent slopes	750	6. 0	6, 800					
Quay fine sandy loam, 1 to 3 percent slopes	550	5. 0	5, 100					
Quay loam, 0 to 1 percent slopes	800	6. 5	7, 000	60				
Quay loam, 1 to 3 percent slopes	600	5. 5	5, 400	45				
Quay loam, 3 to 9 percent slopes		4. 5	4, 500					
Quay loam, sandstone substratum, 0 to 1 percent slopes	700	5. 5	6, 300	55				
Quay loam, sandstone substratum, 1 to 3 percent slopes			4, 800	40				
Quay loam, shale substratum, 1 to 3 percent slopes	500	4. 5	4, 500	35				
Redona loamy fine sand, 0 to 3 percent slopes	750	6. 0	5, 400					
Redona loamy fine sand, 3 to 5 percent slopes		5. 0	4, 100					
Redona loamy fine sand, 0 to 3 percent slopes, hummocky		5. 0	4, 100					
Redona fine sandy loam, 0 to 1 percent slopes	800	7. 0	7, 000	55				
Redona fine sandy loam, 1 to 3 percent slopes	600	5. 5	6, 000	40				
Redona loam, 0 to 1 percent slopes	950	7. 5	7, 200	65				
Redona loam, 1 to 3 percent slopes	700	6. 0	6, 100	50				
San Jose loam, 0 to 1 percent slopes	900	7. 5	7, 500	65				
Springer fine sandy loam, 0 to 3 percent slopes					1, 200	2. 5	375	
Toyah loam, 0 to 3 percent slopes	900	7. 5	7, 500	65	1, 400	2. 5	400	15
Tucamcari clay loam, 0 to 1 percent slopes	950	6. 5	7, 000	65				
Tucumcari clay loam, 1 to 3 percent slopes	700	5. 5	5, 900	50				

Use of the Soils for Range [2]

This subsection discusses rangeland in the survey area and explains range sites and condition classes. Descriptions of range sites are given in which production and use and management are discussed.

Range is the major land use of 85 percent of the Tucumcari Area. Livestock operations in the Area vary from small, submarginal units operating on a few hundred acres to large, more economical ones on several thousand acres. Most range is used throughout the year on ranches having cow-calf-yearling operations.

The Area is climatically suited to year-round grazing. Many ranchers, however, depend on irrigated hay and small-grain pasture for supplemental feed during winter and in years when rainfall is below normal. In places, even though this supplemental feed is available, much of the range is overgrazed or vegetation is of low vigor (fig. 13).

Range sites and range condition

A range site is a distinctive kind of range that differs from other kinds in its potential to produce a character-

[2] By H. E. WALL, JR., and D. D. SYLVESTER, range conservationists, Soil Conservation Service.

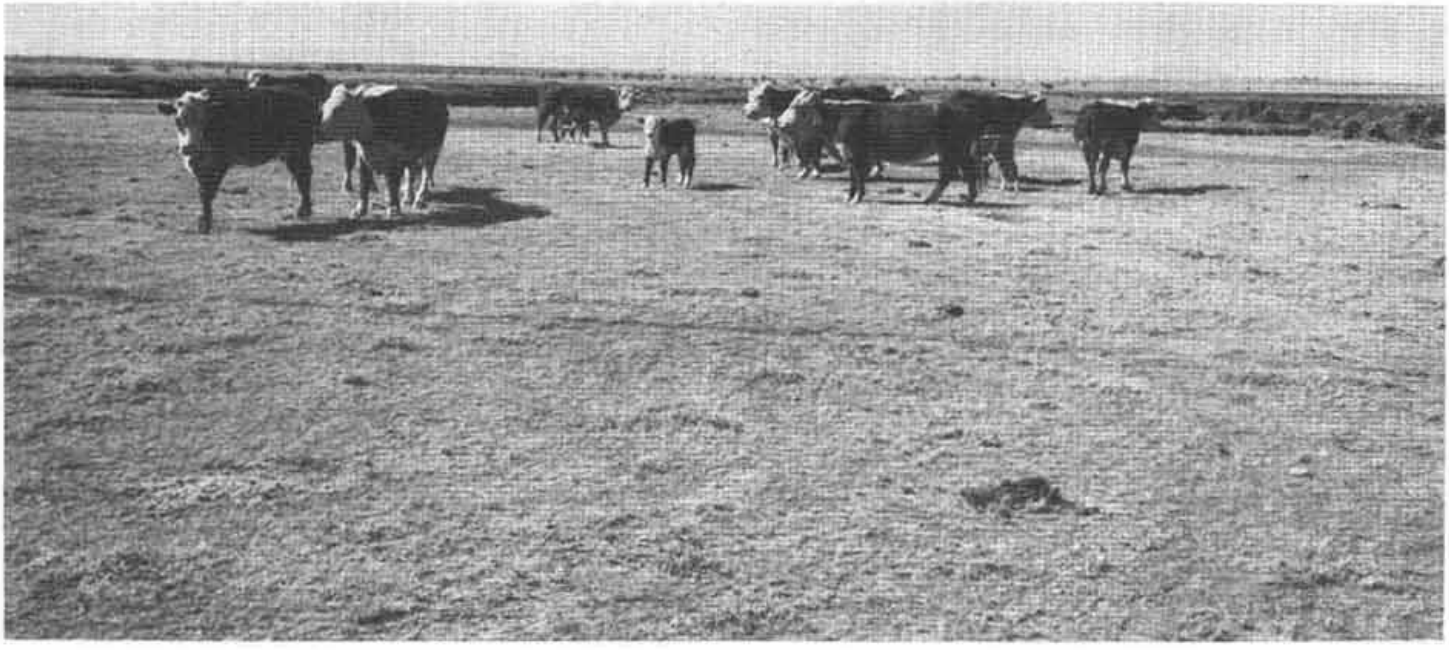

Figure 13.—Overgrazed area of Salt Flats range site. The soil is a Montoya clay loam.

istic natural plant community. It is determined generally by the type of soil, climate, and vegetation in a particular area. In brief, soils having the capacity to produce the same kinds, amounts, and proportions of range plants are grouped into a range site.

The potential, or climax, vegetation of a range site is the native plant community best adapted to the particular environmental complex of the site. The plant community normally is relatively stable and in dynamic equilibrium with the environment. Such abnormal disturbances as overgrazing and excessive burning or plowing result in changes to the climax plant community, and if sufficiently drastic, completely destroy it. If the range site subjected to such disturbances is not also significantly deteriorated by water erosion or soil blowing, secondary plant succession progresses in the direction of the natural potential, or climax, plant community for the site.

Range conservationists and soil scientists work together to determine the natural potential plant communities for individual soil units and to group soils into range sites.

Range condition is the present state of the vegetation or plant community on a range site as related to the climax plant community for the site. The primary purpose in determining range condition is to provide an index of changes that have taken place in the plant cover. When the potential plant community for a site is known, present condition can be determined, and this in turn provides a basis for predicting the nature and direction of plant community changes to be expected from management and treatment measures.

When changes that occur in the climax plant community are due to particular kinds of use or disturbance, some plant species will increase and others will decrease. How a plant reacts to grazing depends on the kind of animal grazed, the season of use, and the degree of plant tissue removal. By comparing the composition of the present-condition plant community to that of the climax plant community, it is possible to learn which individual species have increased and which have decreased. Plants not present in the climax community but which show up in the present-condition community are invaders for the site.

The composition of both present-condition and climax plant communities, together with other pertinent range site information, provides the interpretive basis for selecting management objectives, designing grazing systems, managing wildlife, determining potential for recreation, and evaluating hydrologic conditions.

Management objectives for range generally include increasing desirable plants and restoring areas as closely to the climax condition as reasonably possible. They sometimes include the creating or maintaining of plant communities that are to some extent removed from the climax plant community and fit specific needs of the grazing program, provide for wildlife habitat, or serve other purposes. But in any situation, management objectives should not conflict with conservation objectives. Plant communities can and should be planned that protect and improve soil and water resources as well as meet the needs and desires of the individual operator.

Descriptions of range sites

In the following pages the 10 range sites in the Tucumcari Area are described, and the climax plants and principal invaders for the sites are given. Also given is an estimate of potential annual yield of air-dry herbage for each site when it is in excellent condition. The soil series represented in each site are mentioned, but this does not necessarily mean that all soils of the series are in the site. To determine the range site in which any soil has been placed, refer to the soil in the section "Descriptions of the

Soils" or to the "Guide to Mapping Units" at the back of this survey.

BREAKS RANGE SITE

This range site consists of soils in the Latom series and the land types Rock land (fig. 14), Rock outcrop, and Rough broken and stony land, steep. The soils are stony, shallow to very shallow, and steep to very steep. Outcroppings of rock are common. Slopes are generally more than 30 percent.

The vegetation growing on this site is an open stand of pinyon and juniper and an understory of grasses, forbs, and shrubs. The composition, by weight, of the climax vegetation, or potential plant community, is about 15 percent little bluestem, 20 percent side-oats grama, 20 percent blue and hairy grama, 5 percent western wheatgrass, 10 percent galleta, 5 percent needle-and-thread, 5 percent three-awn, and 20 percent pinyon-juniper. Associated species are black grama, big bluestem, oak brush, mountain-mahogany, and perennial forbs. Under continued heavy grazing, side-oats grama, little bluestem, needle-and-thread, and western wheatgrass decrease in the plant community, and blue grama, galleta, three-awn, and pinyon-juniper increase. Under long-term heavy use, mesquite invades this site in places.

Developing livestock trails and water sources on this site are ways of helping to improve the distribution of grazing. In places areas provide livestock with good protection against severe winter storms.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds per acre in favorable years to 400 pounds in unfavorable years. About 75 percent of this yield is from plants that furnish forage for cattle.

CLAYEY RANGE SITE

This range site consists of moderately deep to deep soils in the San Jon and Tucumcari series. These soils are on uplands. Slopes are 0 to 5 percent. The soils have a surface layer of loam or clay loam and a subsoil of gravelly light clay loam to heavy silty clay loam.

Water intake rate is slow in the soils of this site. Permeability is moderately slow. In years of below-average moisture, production on this site is very low.

The composition, by weight, of the climax vegetation, or potential plant community, is about 15 percent alkali sacaton, 10 percent side-oats grama, 35 percent blue grama, 20 percent galleta, 5 percent buffalograss, 10 percent black grama, and 5 percent four-wing saltbush. Associated species are western wheatgrass, vine-mesquite, cholla cactus, ring muhly, and broom snakeweed. If this site is not properly managed, alkali sacaton, black grama, and side-oats grama decrease and blue grama, galleta, and tobosa increase. Under continued overuse ring muhly and burrograss replace the more desirable increasers. Cholla cactus invades this site in places.

Range seeding and brush control have limited effectiveness on this site. Areas of San Jon soils commonly require structures that help to control erosion.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,100 pounds per acre in favorable years to 300 pounds in unfavorable years. About 90 percent of this yield is from plants that furnish forage for cattle.

DEEP SAND RANGE SITE

This range site consists of soils in the Amarillo, Brownfield, Canez, Gomez, Minneosa, Redona, and Springer series (fig. 15). These soils are moderately deep

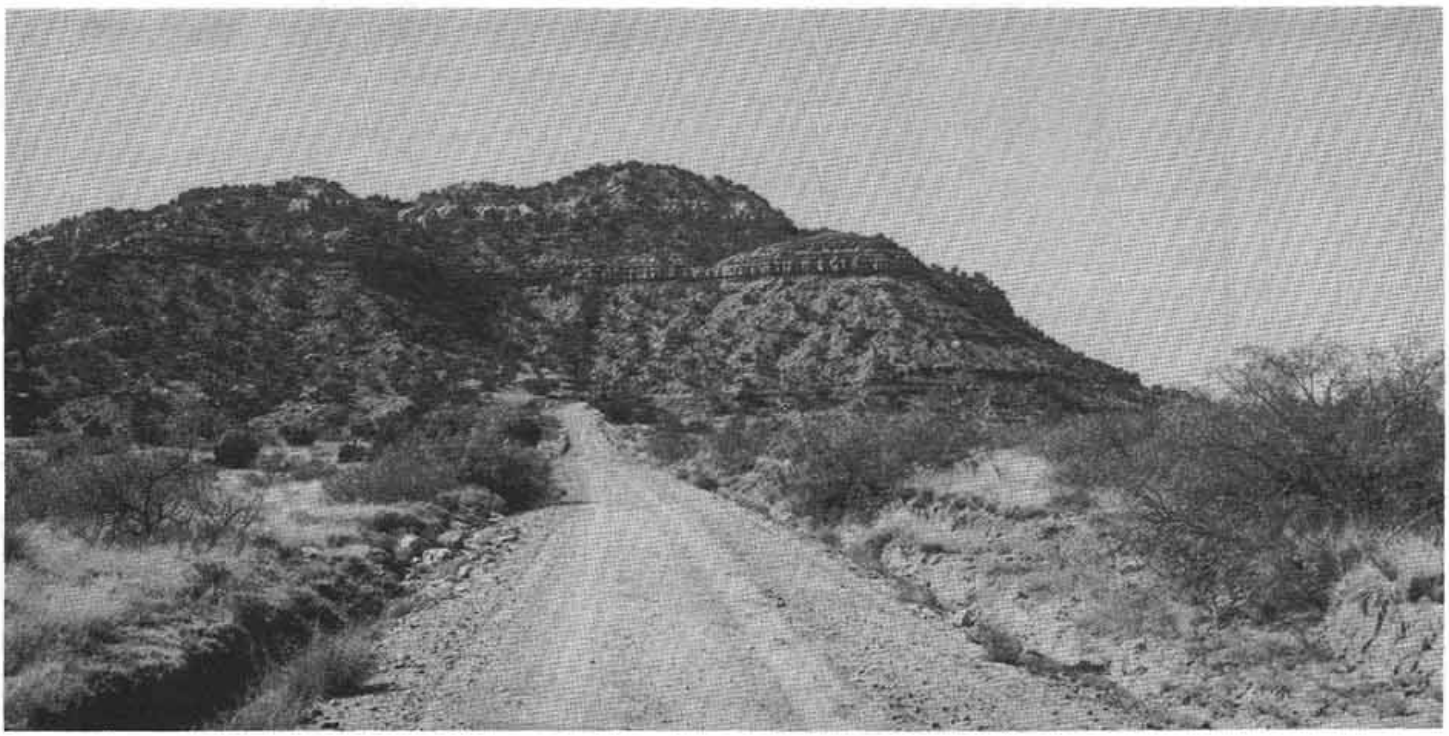

Figure 14.—Area of Rock land in Breaks range site.

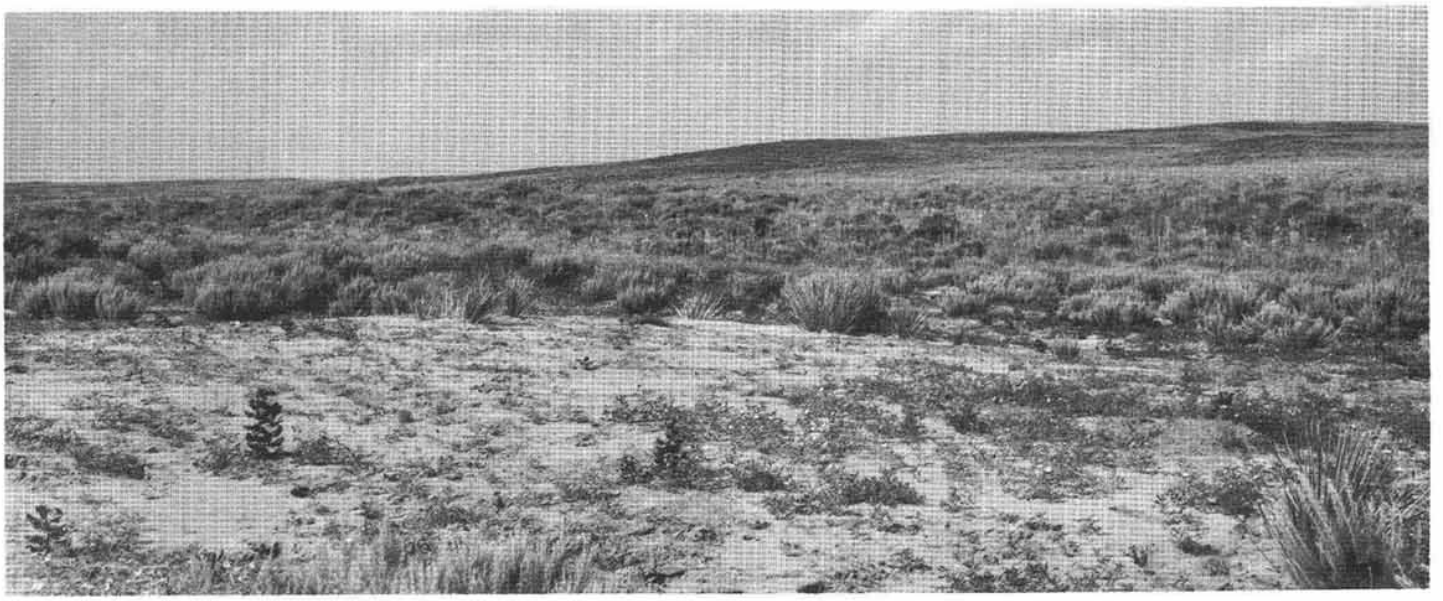

Figure 15.—**Area of Springer loamy fine sand, 0 to 3 percent slopes, in Deep Sand range site.**

to deep to the lime zone. They are on uplands. Slopes are 0 to 9 percent. The soils have a surface layer of fine sand to fine sandy loam underlain by loamy sand to clay loam.

Water intake rate is rapid at the surface of the soils in this site. Permeability is moderate to moderately rapid.

The composition by weight of the climax vegetation, or potential plant community, is about 20 percent little bluestem, 20 percent blue and hairy grama, 15 percent sand bluestem, 15 percent side-oats grama, 10 percent sand dropseed, 5 percent three-awn, 5 percent yucca, 5 percent red lovegrass, and 5 percent sand sagebrush. Associated species are needle-and-thread, New Mexico feathergrass, black grama, mesa dropseed, and silver bluestem. Under heavy use side-oats grama, black grama, and little bluestem are replaced by blue grama, hairy grama, three-awn, sand sagebrush, and small soapweed (yucca).

If the plant cover becomes dominated by low-value woody plants, brush control and range seeding hasten recovery on all areas of this site, provided practices are used that protect the areas against soil blowing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds in favorable years to 1,000 pounds in unfavorable years. About 80 percent of this yield is from plants that furnish forage for cattle.

HILLS RANGE SITE

Only Rough broken and stony land, hilly, is in this range site. It consists of red-bed shale and clay interbedded with sandstone. Slopes are 9 to 25 percent.

Runoff is rapid on the areas of this site. Available water holding capacity is low.

The composition, by weight, of the climax vegetation, or potential plant community, is about 5 percent alkali sacaton, 10 percent black grama, 15 percent little bluestem, 15 percent side-oats grama, 5 percent pinyon ricegrass, 20 percent blue grama, 10 percent galleta, 5 percent fringed sagewort, 10 percent juniper, and 5 percent pinyon pine. Associated species are western wheatgrass, three-awn, needle-and-thread, wolftail, mountain mahogany, and oak. If this site is in poor condition, galleta, mat muhly, three-awn, and broom snakeweed generally dominate. Mesquite and western ragweed invade this site.

Developing carefully planned stock trails is a helpful management practice on this site.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 500 pounds per acre in favorable years to 100 pounds in unfavorable years. About 80 percent of this yield is from plants that furnish forage for cattle.

LOAMY RANGE SITE

This range site consists of moderately deep to deep soils in the Kinkead, Lacita, La Lande, Olton, Quay, Redona, San Jose, and Toyah series, and in the Bascom variant. These soils are on alluvial fans and uplands. Slopes are 0 to 9 percent. The soils have a surface layer of silt loam, loam, or clay loam and an underlying layer of fine sandy loam to clay.

Water intake rate is slow to moderate in the soils of this site. Permeability is slow to moderately rapid.

The composition, by weight, of the climax vegetation, or potential plant community, is about 40 percent blue grama, 10 percent western wheatgrass, 10 percent black grama, 10 percent galleta, 5 percent side-oats grama, 5 percent buffalograss, 5 percent sand dropseed, 5 percent three-awn, 5 percent wolftail, and 5 percent broom snakeweed. Associated species are silver bluestem, vine-mesquite, ring muhly, fringed sagewort, and winterfat. If this site is overgrazed, black grama, side-oats grama, and vine-mesquite decrease, and blue grama, galleta, and ring muhly increase and dominate (fig. 16). Under continued overuse mesquite and cactus invade this site.

If this site deteriorates, range seeding, brush control, and development of water sources for livestock hasten recovery on all areas, but good results also depend upon

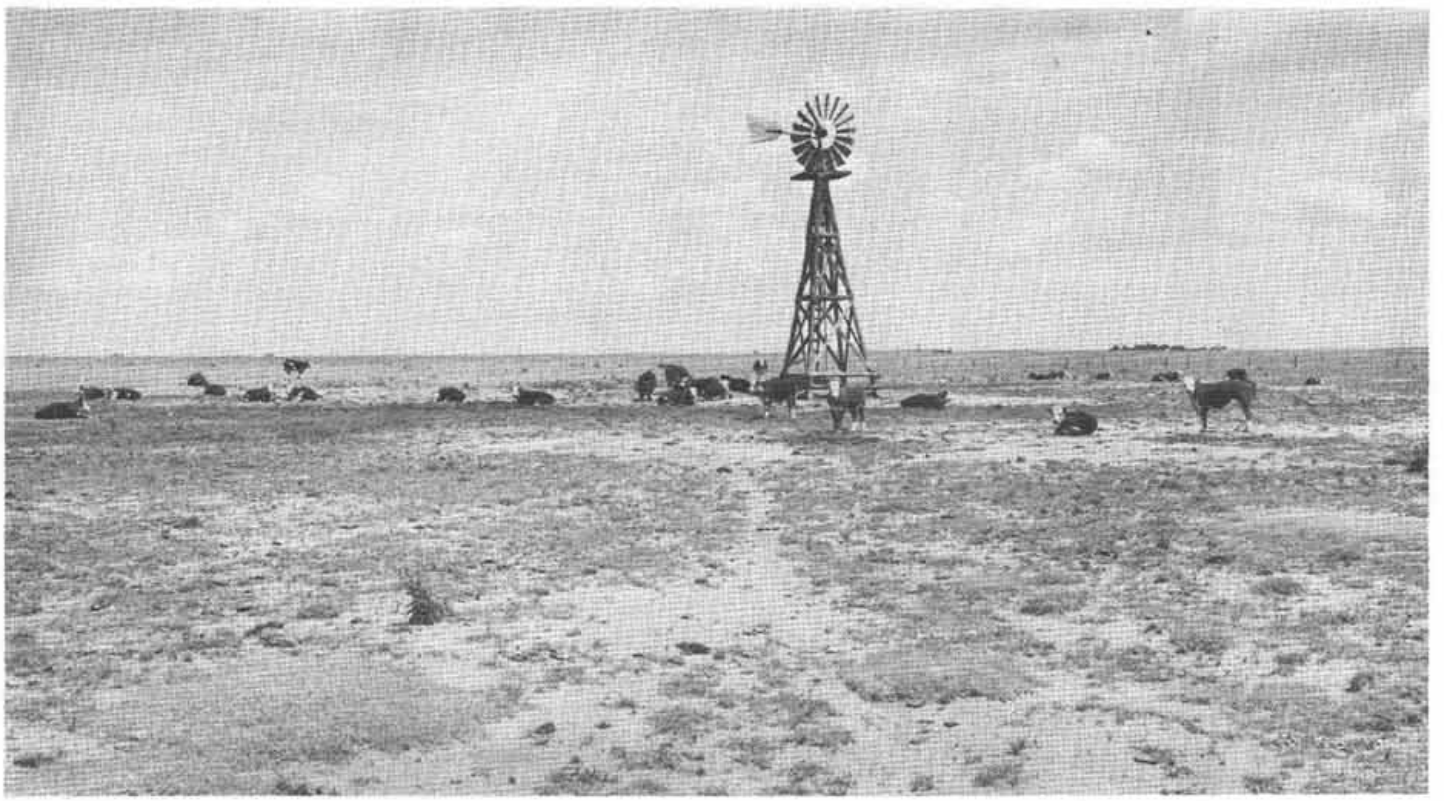

Figure 16.—Overgrazed area of Loamy range site. The soil is Olton loam, 0 to 3 percent slopes.

proper grazing. Deferred grazing and planned grazing are especially beneficial.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,500 pounds per acre in favorable years to 300 pounds in unfavorable years. About 85 percent of this yield is from plants that furnish forage for cattle.

SALT FLATS RANGE SITE

This range site consists of well-drained soils in the Montoya series. Slopes are 0 to 3 percent. The soils have a surface layer of clay loam and a subsoil of clay containing salt.

Permeability is very slow in the soils of this site. Runoff is medium. These soils are subject to occasional flooding by runoff from other soils.

The composition, by weight, of the climax vegetation, or potential plant community, is about 60 percent alkali sacaton, 5 percent blue grama, 10 percent saltgrass, 5 percent switchgrass, 5 percent vine-mesquite, 5 percent alkali muhly, 5 percent fourwing saltbush, and 5 percent tobosa. Associated species are western wheatgrass, mat muhly, silver bluestem, burrograss, and windmillgrass. If this site is extensively overgrazed, alkali sacaton and vine-mesquite decrease greatly or are removed completely and are replaced by tobosa, blue grama, and fourwing saltbush. In places, under continued overgrazing, burrograss invades this site. Some areas of this site are dominated by almost pure stands of tobosa (fig. 17).

Proper grazing practices are important on this site. Deferred grazing and planned grazing are especially helpful for maintaining and improving vegetation. If areas are not properly prepared, range seeding has limited effectiveness on this site. If they are properly prepared, results are generally fair to good.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 3,000 pounds per acre in favorable years to 600 pounds in unfavorable years. About 90 percent of this yield is from plants that furnish forage for cattle.

SAND HILLS RANGE SITE

This range site consists of well-drained to excessively drained soils in the Springer and Tivoli series. Slopes are 0 to 25 percent. The soils have a surface layer of fine sand to loamy fine sand and an underlying layer of fine sand to fine sandy loam.

Permeability is moderately rapid to rapid in the soils of this site. Runoff is very slow to slow.

The composition, by weight, of the climax vegetation, or potential plant community, is about 25 percent sand bluestem, 15 percent little bluestem, 15 percent side-oats grama, 10 percent blue and hairy grama, 10 percent sand dropseed, mesa dropseed, and spike dropseed, 5 percent black grama, 5 percent needle-and-thread, 5 percent giant dropseed, 5 percent sand sagebrush, and 5 percent yucca. Associated species are three-awn, fall witchgrass, yellow indiangrass, switchgrass, plains bristlegrass, and New Mexico feathergrass. If this site is not properly

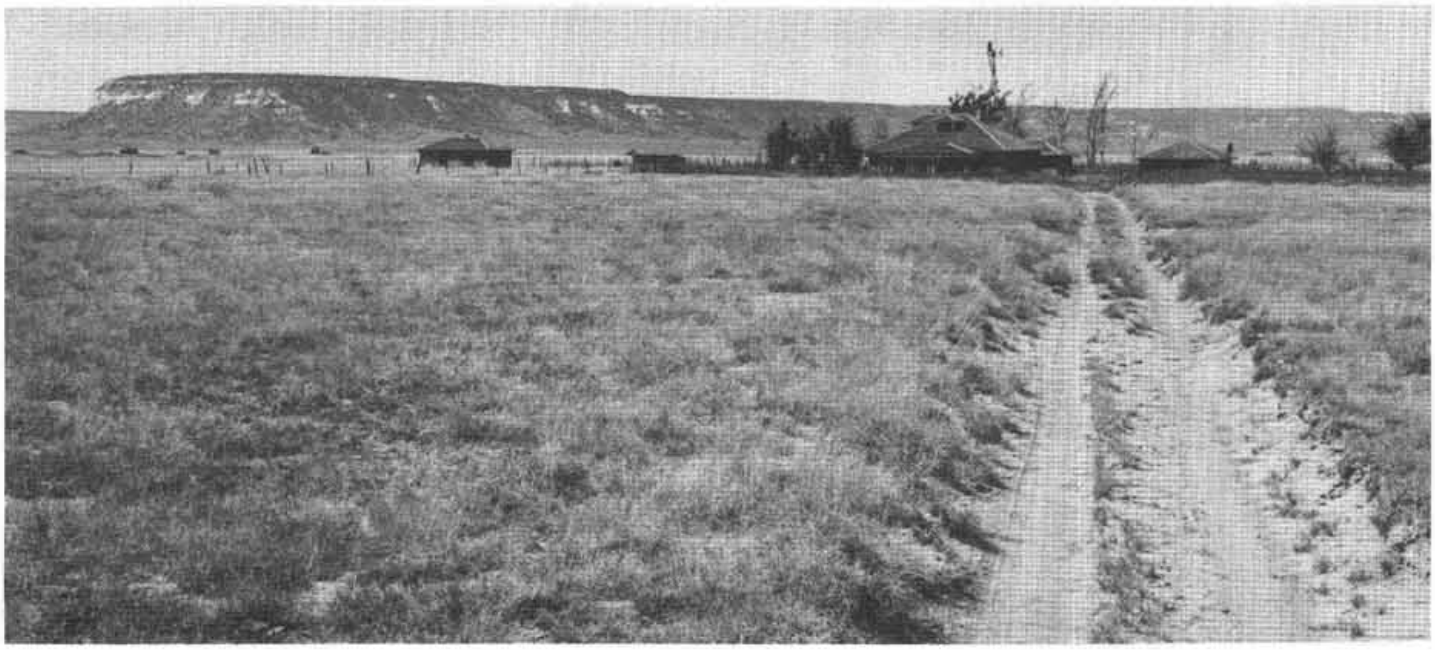

Figure 17.—Area of Montoya clay loam dominated by tobosa in Salt Flats range site.

managed, sand bluestem, little bluestem, and side-oats grama decrease rapidly and are replaced by three-awn, sand dropseed, and sand sagebrush. Under continued overuse active sand dunes develop on this site.

Management for this site is limited mostly to proper grazing. Deferred grazing and planned grazing are especially helpful. Chemical methods of brush control are suitable.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 pounds per acre in favorable years to 900 pounds in unfavorable years. About 80 percent of this yield is from plants that furnish forage for cattle.

SANDY RANGE SITE

This range site consists of well-drained soils in the Amarillo, Bascom, Canez, Ima, La Lande, Los Tanos, Quay, Redona, and Sharvana series; and in the Bascom variant and the Canez variant. Slopes are 0 to 9 percent. The soils have a surface layer of fine sandy loam to sandy loam, or loam that is calcareous. The subsoil is fine sandy loam to clay loam.

Permeability is moderate to moderately rapid in the soils of this site. Runoff is slow to medium.

The composition, by weight, of the climax vegetation, or potential plant community, is about 20 percent little bluestem, 20 percent side-oats grama, 5 percent needle-and-thread, 5 percent New Mexico feathergrass, 10 percent black grama, 5 percent western wheatgrass, 20 percent blue and hairy grama, 5 percent fringed sagewort, 5 percent sand dropseed, and 5 percent yucca. Associated species are sand sagebrush, three-awn, sand bluestem, and winterfat. If this site is not properly managed, side-oats grama, little bluestem, and black grama are replaced by blue grama, three-awn, and sand dropseed. Galleta and mesquite invade this site in places.

Most range practices are effective on this site, but results depend upon proper grazing. Deferred grazing and planned grazing are especially beneficial. If this site deteriorates, range seeding and brush control hasten recovery, provided practices are used that protect the areas against soil blowing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,800 pounds per acre in favorable years to 400 pounds in unfavorable years. About 90 percent of this yield is from plants that furnish forage for cattle.

SHALLOW RANGE SITE

This range site consists of soils in the Gallegos and Potter series. These soils are shallow to very shallow to cemented caliche, or they are very gravelly. The soils are on uplands. Slopes are 1 to 25 percent.

Water intake rate is moderate in the soils of this site, but available water holding capacity is low. Permeability is moderate to moderately rapid.

The composition by weight of the climax vegetation, or potential plant community, is about 15 percent side-oats grama, 20 percent black grama, 20 percent blue and hairy grama, 15 percent little bluestem, 10 percent galleta, 5 percent needle-and-thread, 5 percent New Mexico feathergrass, 5 percent three-awn, and 5 percent broom snakeweed. Associated species are yucca, buckwheat, sand dropseed, slim tridens, hairy tridens, wolftail, and ephedra. Under continued heavy grazing side-oats grama and black grama decrease or are removed completely and are replaced by blue grama, hairy grama, sand dropseed, and galleta. In places, under long-continued overuse, blue grama decreases and broom snakeweed dominates in the plant community.

Proper grazing is necessary on this site. Deferred grazing and planned grazing are especially helpful practices. Chemical methods of brush control are suitable for use on Gallegos soils.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,200 pounds per acre in favorable years to 350 pounds in unfavorable years. About 90 percent of this yield is from plants that furnish forage for cattle.

SHALLOW SANDSTONE RANGE SITE

This range site consists of well-drained soils in the Latom series. These soils are mostly stony loam over sandstone bedrock, which is at a depth of 6 to 20 inches. Outcroppings of rock are common. Slopes are 3 to 25 percent.

Permeability is moderate in the soils of this site. Runoff is medium to rapid. Available water holding capacity is low.

The composition, by weight, of the climax vegetation, or potential plant community, is about 25 percent sideoats grama, 20 percent little bluestem, 20 percent blue and hairy grama, 10 percent sand bluestem, 5 percent New Mexico feathergrass, 5 percent pinyon pine, 10 percent juniper and 5 percent oak. Associated species are big bluestem, yellow indiangrass, silver bluestem, skunkbush sumac, sand sagebrush, wolftail, and galleta. If this site is not properly managed, blue grama, hairy grama, silver bluestem, wolftail, one-seed juniper, wavyleaf oak, skunkbush sumac, and pinyon pine increase and dominate in places.

The soils in this range site are too shallow for mechanical treatment.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,600 pounds per acre in favorable years to 450 pounds in unfavorable years. About 80 percent of this yield is from plants that furnish forage for cattle.

Use of the Soils for Woodland and Windbreaks [3]

No commercial woodland is in the Tucumcari Area. A small, narrow acreage of pinyon, juniper, and oak brush is below the cap rock, between the alluvial valley and uplands of the High Plains (fig. 18). Cottonwood, willow, hackberry, and western soapberry grow in places throughout the survey area. Cottonwood and willow are mostly along waterways, hackberry on caliche breaks, and western soapberry on sandy uplands.

Few field windbreaks are in the Tucumcari Area. Most plantings of trees and shrubs are for farmstead windbreaks. These include the evergreens Oriental arborvitae, Arizona cypress, eastern redcedar, one-seed juniper, Rocky Mountain juniper, ponderosa pine, and pinyon pine, and the decidious plants Siberian elm, honeylocust, Russian mulberry, Russian-olive, wild plum, rose-of-Sharon, multiflora rose, and skunkbush sumac. Of these species, Rocky Mountain juniper, ponderosa pine, Siberian elm, and Russian-olive are most adapted to the Area. Arizona cypress has excellent growth potential but is subject to winterkill in periods of extremely low temperatures. At least one row of evergreens is desirable in a farmstead windbreak. This will provide greater protection in winter and early in spring, before deciduous trees are in leaf.

Water for plantings is by irrigation or the use of engineered sites. Water for the sites generally is collected from adjacent land and led into a system of dikes or retaining terraces within the planting area.

Clean cultivation is a most important factor in establishing and maintaining windbreaks. Generally this means that spacing must be adequate. Trees and shrubs planted too close together in a row are subject to extreme plant competition that stunts or kills them.

The soils of the Area have been grouped in three general categories according to their adaptability for wind-

[3] By EWING MCCLAIN, woodland specialist, Soil Conservation Service.

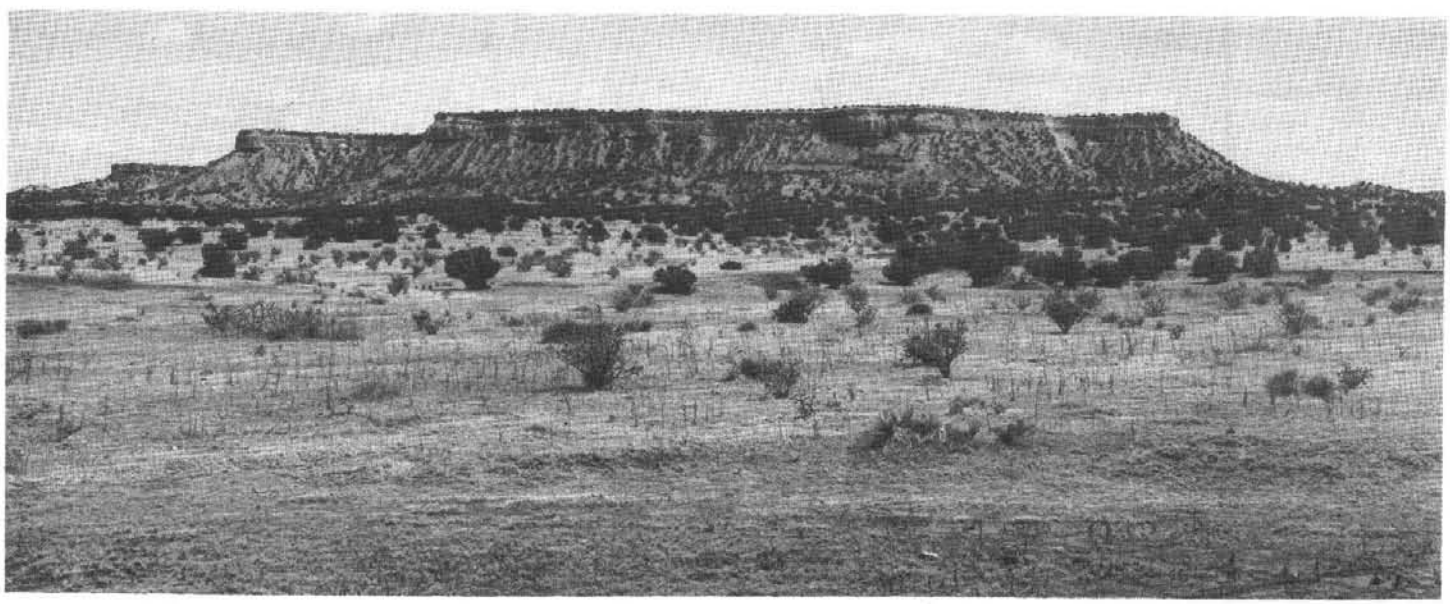

Figure 18.—Woody vegetation below the cap rock. The soils in the foreground are in the Quay-Montoya-Lacita association on the general soil map. The area in the background is in the Rock land-Rough broken and stony land association.

break plantings. Soils are considered *suitable* if they support trees and shrubs that are established and maintained on an engineered site by clean cultivation. Soils are *suitable with limitations* if, because of unfavorable soil texture, depth, or an impervious layer, special treatment to control soil blowing or irrigation is required to establish and maintain plantings. Soils are *unsuitable* if they are shallow, salts are present, water intake is poor, or slopes are steep.

Soils in the survey area that are suitable for windbreaks are:

Amarillo fine sandy loam, 0 to 3 percent slopes.
Canez fine sandy loam, 0 to 3 percent slopes.
Canez fine sandy loam, 1 to 5 percent slopes.
Kinkead clay loam, 0 to 1 percent slopes.
Kinkead clay loam, 0 to 3 percent slopes.
Kinkead clay loam, 1 to 3 percent slopes.
La Lande fine sandy loam, 0 to 1 percent slopes.
La Lande fine sandy loam, 1 to 3 percent slopes.
La Lande fine sandy loam, 1 to 5 percent slopes.
La Lande loam, 0 to 1 percent slopes.
La Lande loam, 1 to 3 percent slopes.
La Lande loam, 0 to 5 percent slopes.
La Lande loam, 3 to 5 percent slopes.
Olton loam, 0 to 3 percent slopes.
Redona fine sandy loam, 0 to 1 percent slopes.
Redona fine sandy loam, 0 to 3 percent slopes.
Redona fine sandy loam, 1 to 3 percent slopes.
Redona loam, 0 to 1 percent slopes.
Redona loam, 1 to 3 percent slopes.
San Jose loam, 0 to 1 percent slopes.
San Jose loam, 0 to 3 percent slopes.
Springer fine sandy loam, 0 to 3 percent slopes.
Springer fine sandy loam, 3 to 9 percent slopes.
Toyah loam, 0 to 3 percent slopes (Th, TK).
Tucumcari clay loam, 0 to 1 percent slopes.
Tucumcari clay loam, 0 to 3 percent slopes.
Tucumcari clay loam, 1 to 3 percent slopes.

Soils in the survey area that, with limitations, are suitable for windbreaks are:

Amarillo loamy fine sand, 0 to 3 percent slopes.
Bascom fine sandy loam, 0 to 3 percent slopes.
Bascom fine sandy loam, 3 to 9 percent slopes.
Bascom loam, 0 to 3 percent slopes.
Bascom loam, 3 to 9 percent slopes.
Bascom complex.
Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes.
Bascom loam, nongravelly variant, 0 to 3 percent slopes.
Brownfield fine sand, 0 to 3 percent slopes.
Canez loamy fine sand, 0 to 3 percent slopes.
Canez loamy fine sand, 1 to 5 percent slopes.
Canez loamy fine sand, 3 to 9 percent slopes.
Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes (Ch, Cl).
Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes.
Canez loam, calcareous variant, 0 to 3 percent slopes.
Ima sandy loam, 1 to 3 percent slopes.
Ima sandy loam, 1 to 5 percent slopes.
Ima sandy loam, 3 to 5 percent slopes.
Lacita silt loam, 0 to 1 percent slopes.
Lacita silt loam, 0 to 3 percent slopes.
Lacita silt loam, 1 to 3 percent slopes.
Los Tanos sandy loam, 1 to 5 percent slopes (Lx, LY).
Montoya clay loam.
Montoya clay loam, 0 to 1 percent slopes.
Montoya clay loam, 1 to 3 percent slopes.
Quay fine sandy loam, 0 to 1 percent slopes.
Quay fine sandy loam, 1 to 3 percent slopes.
Quay loam, 0 to 1 percent slopes.
Quay loam, 1 to 3 percent slopes.
Quay loam, 0 to 5 percent slopes.
Quay loam, 3 to 9 percent slopes.
Quay loam, sandstone substratum, 0 to 1 percent slopes.
Quay loam, sandstone substratum, 1 to 3 percent slopes.
Quay loam, shale substratum, 1 to 3 percent slopes.
Quay loam, shale substratum, 1 to 5 percent slopes.
Redona loamy fine sand, 0 to 3 percent slopes (Rd, RE).
Redona loamy fine sand, 3 to 5 percent slopes.
Redona loamy fine sand, 0 to 3 percent slopes, hummocky.
Springer-Amarillo association.
Springer loamy fine sand, 0 to 3 percent slopes.
Springer loamy fine sand, 3 to 9 percent slopes.

Soils in the survey area that are unsuitable for windbreaks are:

Amarillo loamy fine sand, eroded.
Bascom-Potter fine sandy loams, 1 to 9 percent slopes.
Bascom-Potter loams, 1 to 9 percent slopes.
Bascom-Potter complex, 1 to 9 percent slopes.
Brownfield fine sand, eroded.
Canez loamy fine sand, 0 to 3 percent slopes, hummocky.
Dune land.
Gallegos very gravelly loam, 1 to 9 percent slopes.
Gallegos very gravelly loam, 9 to 25 percent slopes (Gg, GH).
Gallegos complex, 3 to 9 percent slopes.
Gomez loamy fine sand, 0 to 3 percent slopes (Gm, GN).
Gullied land, San Jon material.
Lacita silt loam and Gullied land.
Latom stony loam, 3 to 9 percent slopes.
Latom stony sandy loam, 3 to 9 percent slopes.
Latom-Rock outcrop complex, hilly.
Latom-Rock outcrop complex, steep.
Minnesoa loamy fine sand (Mn, MO).
Montoya clay loam and Gullied land.
Potter loam, 1 to 9 percent slopes (Po, PT).
Redona loamy fine sand, 0 to 3 percent slopes, eroded.
Riverwash (Rr, RS).
Rock land (Rt, RU).
Rough broken and stony land, hilly (Rv, RW).
Rough broken and stony land, steep (Rx, RY).
San Jon loam, 1 to 5 percent slopes (Sa, SB).
Sharvana sandy loam, 0 to 3 percent slopes.
Springer loamy fine sand, 0 to 3 percent slopes, eroded.
Tivoli fine sand.

Use of the Soils for Wildlife [4]

In this subsection types of wildlife habitat in New Mexico are described, and the soils of the Tucumcari Area are placed in wildlife habitat groups. Characteristics of the soils are briefly presented in the description of each group, and suitability of the soils for various types of wildlife habitat is rated.

Common types of wildife in the survey area are antelope, dove, duck, and quail. Some pheasant, grouse, and deer are also present. Deer are not abundant, mostly because woody vegetation and similar browse are lacking. Most of the fish in the Area are in Ute Reservoir.

Types of wildlife habitat

The amount and distribution of wildlife in an area is generally determined by the nature and suitability of available habitat. The kind, quality, and extent of wildlife habitat in turn is directly affected by the intensity of soil uses for crops, pasture, and timber.

Trees and shrubs suitable for wildlife food and cover have been planted in some parts of the survey area. These plantings are mostly in odd field corners and areas unsuitable for cultivation.

[4] CARL H. THOMAS, biologist, Soil Conservation Service, assisted in preparing this subsection.

Ten general types of wildlife habitat are in New Mexico. Differences in types are based on variations in vegetation, climate, physiography, and cultural development. The following brief descriptions emphasize the main characteristics of each type.

Mountain forests.—These are areas of large trees and associated grasses, forbs, and shrubs. Vegetation is mostly established by natural process, but in places the areas have been planted. The major plants are fir, spruce, aspen, ponderosa pine, snowberry, buffaloberry, mountainmahogany, sedge, squawbush, serviceberry, cliffrose, and fescue.

Foothill treees and shrubs.—These are areas of small native trees and shrubs and associated grasses and forbs near mountains and steeper slopes. The major plants are pinyon pine, juniper, blue grama, side-oats grama, mountainmahogany, and oak.

Tall or short grass prairies.—These are areas on lower parts of mountains and rolling plains that have a cover of native grasses, shrubs, and forbs. Vegetation is mostly established by natural processes. The major plants are blue grama, bluestem, buffalograss, vine-mesquite, and tobosa. Sunflower, croton, and pigweed grow in disturbed or water-ponded depressions.

Semidesert shrubs and grasses.—These are areas classified as cool arid or hot arid, where the vegetation is native plants that generally are established by natural process. The major plants are side-oats grama, bluestem, indiangrass, three-awn, sand sagebrush, alkali sacaton, Apacheplume, mesquite, small soapweed (yucca), and cactus.

Domestic seed and grain crops.—These are areas of cultivated fields planted to domestic grain and seed-producing annual herbaceous crops. The major crops are barley, oats, grain sorghum, wheat, Japanese millet, and proso millet.

Domestic pastures and haylands.—These are areas planted to domestic perennial grasses and herbaceous legumes. The major plants are alfalfa, clover, fescue, and weeping lovegrass.

Wetland plants.—These are moist to wet areas where vegetation is wetland plants, exclusive of submerged and floating aquatics. Plants are salt tolerant in some places and not in others. The major freshwater plants are smartweed, wild millet, and sedge. The major salt-adapted plants are saltmarsh, bulrush, saltgrass, and cattail.

Shallow-water impoundments.—These are areas present throughout the Tucumcari Area that provide supplemental water primarily for livestock and secondarily for wildlife.

Deep-water impoundments.—These are areas consisting of three lakes in the Tucumcari Area: Ute Reservoir, which is a permanent artificial reservoir near the town of Logan, and Hudson and Tucumcari Lakes, which are natural, wet-weather lakes.

Bosque bottoms.—These are areas of native trees, grasses, and shrubs adjacent to major streams and rivers. Vegetation is present mostly because of water availability, but these areas are not excessively wet. The major plants are cottonwood, willow, and tamarisk.

Of the preceding types of wildlife habitat, the ones dominant in the Tucumcari Area are tall or short grass prairies, semidesert shrubs and grasses, domestic seed and grain crops, domestic pastures and haylands, shallow-water impoundments, and deep-water impoundments.

Wildlife habitat groups

Soil behavior influences vegetation, and vegetation is a highly important and fundamental element of wildlife habitat. This relationship between soil and wildlife, though indirect, is a basis for rating suitability of soils for types of wildlife habitat. Thus, soils having nearly identical ratings are placed in what is known as a wildlife habitat group, and the group is then given a suitability rating for various kinds of wildlife significant to an area. In table 3 the soils of the Tucumcari Area have been grouped and rated in this manner. The group in which a specific soil has been placed can be determined by referring to the description of that soil in the section "Descriptions of the Soils" or by referring to the "Guide to Mapping Units" at the back of this survey.

A rating of *poor* in table 3 indicates that habitat for the listed species is very expensive or impractical to establish, improve, or maintain; and that for this type of habitat the soils in the group have severe limitations that require intensive management to overcome, or that are impossible or impractical to overcome. A rating of *fair to good* indicates that habitat for the listed species generally can be established, improved, or maintained satisfactorily; and that for this type of habitat the soils in the group have moderate limitations that require a moderate intensity of management and frequent attention to overcome. A rating of *excellent* indicates that habitat for the listed species can be established, improved, or maintained easily; and that for this type of habitat the soils in the group have slight limitations or no limitations.

In the following pages the six wildlife habitat groups in the Tucumcari Area are described. As in table 3, the ratings and information given relate only to capability of the soils to provide habitat suitable for indicated types of wildlife. They do not necessarily describe existing habitat. Onsite investigations therefore are necessary when planning actual structures or activities concerned with wildlife.

WILDLIFE HABITAT GROUP A

In this group are deep or moderately deep soils that have a surface layer of loam to fine sandy loam. These soils are on smooth topography in the major regions of dryfarmed and irrigated cropland throughout the survey area. They are mostly level to gently sloping. Slopes range from 0 to 9 percent but are dominantly 0 to 5 percent. The vegetation is mostly mid and short grasses and such shrubs as cholla cactus and mesquite. Yucca is present in places.

The soils in this group are suitable for the domestic seed and grain crops and the domestic pastures and haylands types of wildlife habitat. They are moderately suited to the tall- or short-grass prairies and the semidesert shrubs and grasses types of wildlife habitat. They are moderately suited to development of the wetland plants and the shallow-water impoundments types of wildlife habitat. The soils are excellent as habitat for pheasant, dove, and quail; fair to good as habitat for antelope, duck, and fish; and poor as habitat for deer.

TABLE 3.—*Suitability of soils in wildlife habitat groups for significant types of wildlife*

Wildlife habitat group and description of soils	Suitability of soils		
	Poor as habitat for—	Fair to good as habitat for—	Excellent as habitat for—
Group A: Deep or moderately deep soils having a surface layer of loam or fine sandy loam.	Deer	Antelope, duck, fish	Pheasant, dove, quail.
Group B: Deep or moderately deep soils having a surface layer of sandy loam, loamy fine sand, or fine sand.	Deer, duck, fish	Antelope, pheasant	Dove, quail.
Group C: Shallow or very shallow soils having variable texture.	Duck, pheasant, fish	Deer, antelope, dove, quail.	
Group D: Deep soils having a surface layer of clay loam to silt loam.	Deer, antelope	Pheasant	Dove, quail, duck, fish.
Group E: Shallow to very shallow, very steep to hilly, rough broken, stony, or rocky land types and soils.	Antelope, pheasant, dove, quail, duck, fish.	Deer.	
Group F: Variable land types	Antelope, deer, pheasant, dove, quail, duck, fish.		

WILDLIFE HABITAT GROUP B

In this group are deep or moderately deep soils having a surface layer that is mostly loamy fine sand but that ranges from sandy loam to fine sand. These soils are throughout the survey area but mainly in the northeastern part. They are mostly undulating. Slopes range from 0 to 15 percent but are dominantly 1 to 5 percent. The vegetation is a mixture of mid and tall grasses and such shrubs as sand sagebrush, yucca, and mesquite.

If the soils in this group are irrigated, most of them are suitable for the domestic seed and grain crops or the domestic pastures and haylands type of wildlife habitat. They are moderately suited to the tall- or short-grass prairies and the semidesert shrubs and grasses types of wildlife habitat. These soils are excellent as habitat for dove and quail; fair to good as habitat for antelope and pheasant; and poor as habitat for deer, duck, and fish. Areas of this group of soils are frequented by such predators as coyote and fox.

WILDLIFE HABITAT GROUP C

In this group are moderately deep to very shallow or very gravelly soils that have a surface layer of loam or fine sandy loam to stony sandy loam or very gravelly loam. These soils are throughout the survey area. They are mostly nearly level to moderately sloping. Slopes are 0 to 25 percent, but mainly 1 to 9 percent. The vegetation is a mixture of midgrasses and shrubs.

The soils in this group are used mostly for range. They are generally unsuitable for the domestic seed and grain crops and the domestic pastures and haylands types of wildlife habitat. They are moderately suited to the tall- or short-grass prairies and the semidesert shrubs and grasses types of wildlife habitat. These soils are fair to good as habitat for deer, antelope, dove, and quail. They are poor as habitat for duck, pheasant, and fish.

WILDLIFE HABITAT GROUP D

In this group are deep soils that have a surface layer of clay loam to silt loam. These soils are on smooth topography and are level to nearly level. They are mostly throughout the central part of the survey area. Slopes are mostly 0 to 3 percent. The vegetation is mainly short grasses. The principal shrubs are cholla cactus and mesquite. Some alkali sacaton and tobosa, and a few saltcedar, are also present.

If the soils in this group are irrigated, they are suitable for the domestic seed and grain crops and the domestic pastures and haylands types of wildlife habitat. The soils are moderately suited to the semidesert shrubs and grasses type of wildlife habitat. They are suited to development of the wetland plants and the shallow-water impoundments types of wildlife habitat. These soils are excellent as habitat for dove, quail, duck, and fish; fair to good as habitat for pheasant; and poor as habitat for deer and antelope.

WILDLIFE HABITAT GROUP E

In this group are rough broken, stony or rocky, shallow to very shallow soils and land types that are along areas of plains breaks, stream and river drainage basins, and rolling hills. Locally the areas are known by such names as river breaks, shale breaks, Palomas hills, and High Plains escarpment. These soils and land types are hilly to very steep. Slopes are 9 to 80 percent. The vegetation is widely variable. It includes short, mid, and tall grasses and some saltgrass and shrubs. The shrubs range from saltcedar to pinyon, juniper, and oak brush.

The soils and land types in this group are used mostly for range. They are moderately suited to the foothill trees and shrubs and the semidesert shrubs and grasses types of wildlife habitat. They are fair to good as habitat for deer (fig. 19), and poor as habitat for antelope,

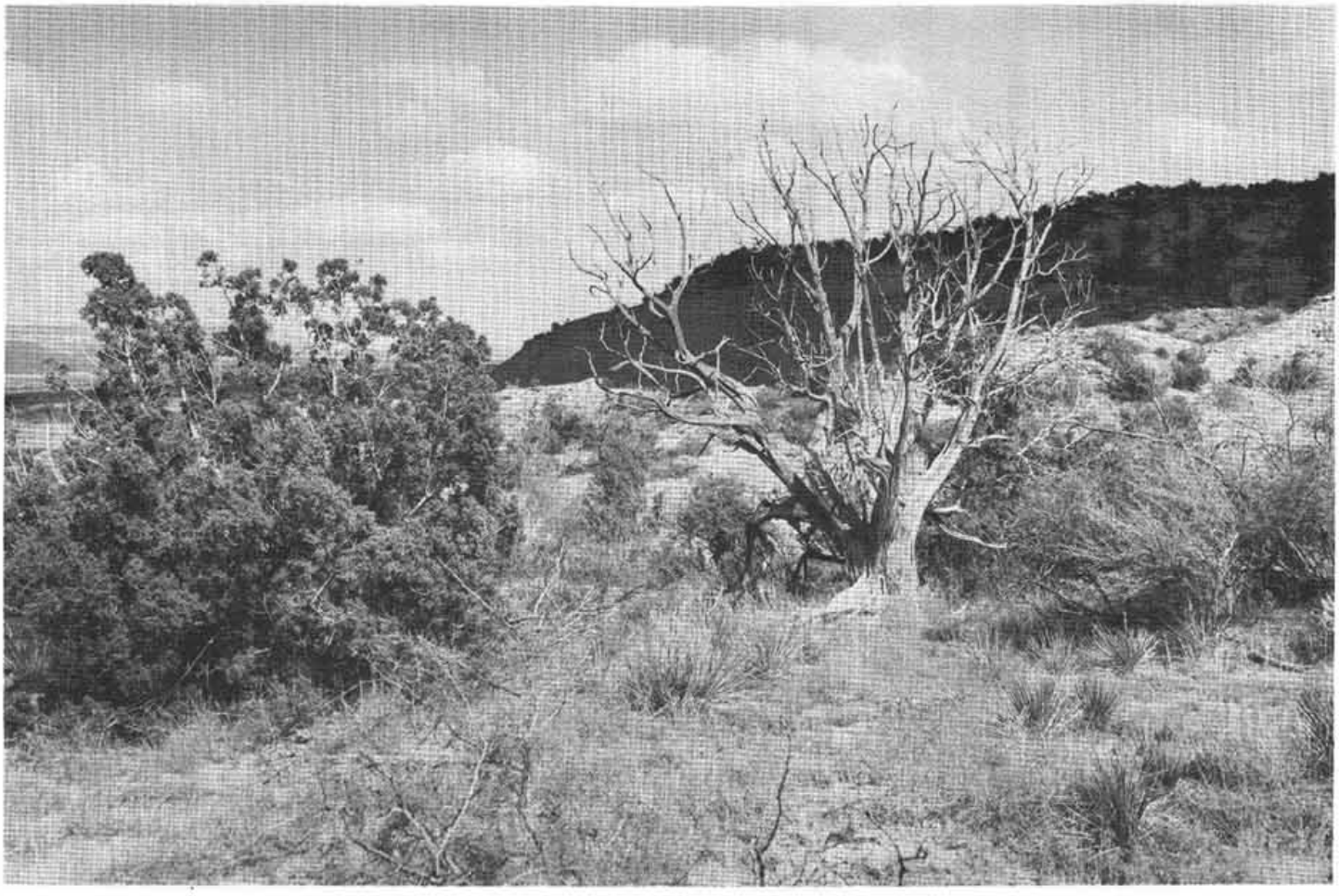

Figure 19.—Area of deer browse in wildlife habitat group E.

pheasant, dove, quail, duck, and fish. Ute Reservoir, a deep-water impoundment, was built mainly in the soils and land types of this group.

WILDLIFE HABITAT GROUP F

This wildlife habitat group consists of land types that are generally unsuitable for production of vegetation for wildlife habitat.

These land types are poor as habitat for antelope, deer, pheasant, dove, quail, duck, and fish.

Engineering Uses of the Soils [5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to bedrock, depth of unconsolidated material, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, erosion-control structures, drainage systems, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate locations for airports and alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on

[5] WILEY MILLER, area engineer, Soil Conservation Service, assisted in preparing this section.

which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.

6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4, 5, and 6, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps and reports.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering. Even in such situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used in this soil survey have special meaning to soil scientists which may not be known to all engineers. The Glossary defines many of these terms commonly used in soil science, as does the Soil Survey Manual (*10*).

Engineering classification system

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*11*) established by the U.S. Army Corps of Engineers and adopted by the U.S. Department of Defense and others, and the system adopted by the American Association of State Highway Officials (AASHO) (*1*). Both classification systems are used in this survey. They are explained in the PCA Soil Primer (*5*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. SW and SP are clean sands, SM and SC are sands that have fines of silt and clay, ML and CL are silts and clays that have a low liquid limit, and MH and CH are silts and clays that have a high liquid limit. Soils on the borderline between two classes are designated by symbols for both classes; for example, SP–SM.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest.

The estimated classification, in both the Unified and AASHO systems, for all the soils mapped and tested in the survey area is given in table 4.

Estimated engineering properties of the soils

Table 4 gives the estimated properties of the soils in the Tucumcari Area that are significant in engineering. The information in the table was based on data compiled for the soil survey and on the test data shown in table 6.

Depth to bedrock or cemented caliche is measured in feet from the surface and is the range in which bedrock or caliche is present in most areas of a particular soil. Bedrock is the solid or fractured rock that generally underlies the soil and other unconsolidated material. Cemented caliche is material that is strongly cemented to indurated with calcium carbonate, and that does not soften when it is wet for a long time.

Depth from surface gives the depth to the significant layers for which properties have been estimated. These layers are described in the section "Descriptions of the Soils." The estimates of properties of these significant layers given in the succeeding columns are ranges in values for a typical soil profile. Variations from these values are to be expected.

The three columns under the heading "Classification" show texture as it is classified both by soil scientists and by engineers. USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is made up of particles less than 2 millimeters in diameter. The terms "sand," "silt," and "clay," and some other terms used in the USDA textural classification, are defined in the glossary of this survey.

The coarse fraction consisting of particles more than 3 inches in diameter was not measured in the mechanical analysis. The percentages were obtained by field observation at the time the soil samples were collected.

The estimated percentage of soil material passing sieves No. 4, No. 10, No. 40, and No. 200 reflects the normal range for a soil series. Because grain size of any soil varies considerably, it should not be assumed that the range shown in the table will apply to all samples of a specific soil, nor that the engineering classification will invariably be as shown.

Permeability relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on texture, structure, bulk density, and porosity of the soil. Plowpans, surface crusts, and other properties resulting from the use of the soil are not considered.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear in the first column of this table.

Soil series and map symbols [1]	Depth to bedrock or cemented caliche	Depth from surface (typical profile)	Classification [2]		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Amarillo: AL, AM, AR	>5	0–8	Fine sandy loam or loamy fine sand.	SM	A–2 or A–4
		8–60	Sandy clay loam, and heavy fine sandy loam.	SC or CL	A–4 or A–6
*Bascom: BA, BB, BC, BD, BE, BF, BG, Bh. For properties of the Bascom soil, nongravelly variant, in BE, and of the Potter soil in BF, BG, and Bh, see the Bascom series, nongravelly variant, and the Potter series.	>5	0–16	Fine sandy loam	SM or ML	A–4
		16–36	Very gravelly fine sandy loam	GM	A–1 or A–2
		36–72	Fine sandy loam and loam	SM or ML	A–4
Bascom, variant: BK, BM	>5	0–13	Fine sandy loam and loam	SM or ML	A–4
		13–35	Sandy clay loam and fine sandy loam.	SC or CL	A–4 or A–6
		35–60	Clay loam	CL	A–6
Brownfield: BN, BO	>5	0–20	Fine sand and loamy sand	SM	A–2
		20–63	Sandy clay loam	SC	A–4
Canez: Ca, CB, Cc, Cd, Ce, CF	>5	0–8	Fine sandy loam or loamy fine sand.	SM	A–2 or A–4
		8–67	Sandy clay loam	SC or CL	A–6
Canez, variant: Ch, CI, Cn, CV	>5	0–15	Fine sandy loam	SM or ML	A–4
		15–60	Sandy clay loam and loam	SC or CL	A–6
Dune land: DU	>5	0–60	Sand	SP, SP–SM	A–3
Gallegos: GA, Gg, GH, GI	>5	0–18	Very gravelly loam	GC	A–1
		18–60	Soft caliche of very gravelly loam texture.	GC or GM	A–1
Gomez: Gm, GN	>5	0–11	Loamy fine sand	SM	A–2
		11–34	Sandy loam	SM	A–2 or A–4
		34–60	Silt loam	ML	A–4
Gullied land, San Jon material: GU. Too variable to be rated.					
Ima: Im, IN, Is	>5	0–60	Sandy loam and fine sandy loam	SM	A–2 or A–4
Kinkead: KL, Km, Kn	>5	0–60	Heavy clay loam, heavy silty clay loam, and clay.	CH	A–7
*Lacita: La, LC, Ld, LE Gullied land part of LE too variable to be rated.	>5	0–36	Silt loam	ML	A–4
		36–72	Silty clay loam	CL	A–4
La Lande: LI, Lm, LN, Lo, Lp, LR, Ls	>5	0–12	Loam or fine sandy loam	ML or SM	A–4
		12–42	Clay loam	CL	A–6 or A–4
		42–60	Fine sandy loam	SM or ML	A–4

See footnotes at end of table.

significant to engineering

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully any instructions
The symbol > means more than and the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm*		
	100	100	75–85	30–50	2. 0–6. 3	0. 09–0. 15	6. 6–7. 3	0–1	Low	Low.
	100	100	80–90	40–60	0. 63–2. 0	0. 14–0. 16	7. 4–8. 4	0–1	Low to moderate.	Moderate.
	90–100	85–100	60–85	35–55	2. 0–6. 3	0. 13–0. 15	7. 9–8. 4	0–1	Low	Low.
0–10	40–60	35–55	30–50	15–35	2. 0–6. 3		8. 5–9. 0	1–4	Low	Moderate.
	90–100	85–100	60–90	35–65	2. 0–6. 3		8. 5–9. 0	1–4	Low	Moderate.
	100	100	75–90	40–60	0. 63–2. 0	0. 13–0. 18	6. 6–7. 8	0–1	Low	Low.
	100	100	75–85	35–55	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	0–1	Low to moderate.	Low to moderate.
	100	100	90–100	70–80	0. 63–2. 0		7. 9–8. 4	1–4	Moderate	Moderate.
	100	100	95–100	15–30	6. 3–20. 0	0. 05–0. 07	6. 6–7. 3	0–1	Low	Low.
	100	100	95–100	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	0–1	Low to moderate.	Moderate.
	100	100	75–85	30–50	2. 0–6. 3	0. 09–0. 15	6. 6–7. 3	0–1	Low	Low.
	100	100	80–90	35–55	0. 63–2. 0	0. 14–0. 16	6. 6–8. 4	0–1	Low to moderate.	Moderate.
	100	100	70–85	40–55	0. 63–2. 0	0. 13–0. 15	7. 4–7. 8	0–1	Low	Low.
	100	100	80–90	35–55	0. 63–2. 0	0. 14–0. 16	7. 9–9. 0	1–4	Low to moderate.	Moderate.
	100	80–100	55–65	0–10	>20. 0	0. 04–0. 06	6. 6–7. 8	0–1	Low	Low.
0–10	35–45	25–35	20–30	15–25	2. 0–6. 3	0. 07–0. 09	6. 6–8. 4	0–1	Low	Low.
0–10	40–50	35–45	25–35	10–25	2. 0–6. 3		7. 9–8. 4	0–1	Low	Low.
	100	100	50–75	15–30	6. 3–20. 0	0. 08–0. 10	6. 6–7. 3	0–1	Low	Low.
	100	100	60–70	30–40	2. 0–6. 3	0. 11–0. 13	7. 4–8. 4	0–4	Low	Low to moderate.
	100	100	90–100	70–90	2. 0–6. 3		7. 9–8. 4	2–4	Low	Moderate.
	100	100	90–100	25–45	2. 0–6. 3	0. 11–0. 15	7. 4–8. 4	0–1	Low	Low.
	100	100	95–100	65–75	0. 06–0. 20	0. 14–0. 21	6. 6–8. 4	0–4	High	High.
	100	100	95–100	85–95	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	2–4	Low	Moderate.
	100	100	95–100	90–100 40–80	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	2–4	Moderate	Moderate.
	100	100	90–100		0. 63–2. 0	0. 13–0. 18	7. 9–8. 4	0–1	Low	Low.
	100	100	95–100	85–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–1	Moderate	Moderate.
	100	100	90–100	40–55	0. 63–2. 0	0. 13–0. 15	7. 9–8. 4	0–1	Low	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols [1]	Depth to bedrock or cemented caliche	Depth from surface (typical profile)	Classification [2]		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
*Latom: Lt, LU, LV, LW Rock outcrop parts of LV and LW too variable to be rated.	0. 5–1. 5	0–12 12	Stony sandy loam Sandstone bedrock.	SM	A–2
Los Tanos: Lx, LY	1. 5–3. 5	0–24 24	Sandy loam Sandstone bedrock.	SM	A–2 or A–4
Minneosa: Mn, MO	>5	0–44 44–60	Loamy sand Silt loam	SM ML	A–2 A–4
*Montoya: MP, Mr, Ms, MT Gullied land part of MT too variable to be rated.	>5	0–60	Clay	CH	A–7
Olton: OT	>5	0–9	Loam	ML or CL	A–4 or A–6
		9–46	Clay loam	CL	A–6 or A–7
		46–60	Sandy clay loam	SC or CL	A–6
Potter: Po, PT	0. 5–1. 0	0–8 8	Loam Cemented caliche.	ML	A–4
Quay: Qd, Qe, Qf, Qg, QH, Qk	3. 5–5 or more	0–9	Loam or fine sandy loam	ML or SM	A–4
		9–26	Clay loam	CL	A–6 or A–4
		26–60	Clay loam	CL	A–4
Quay, sandstone and shale substratums: Ql, Qm, Qn, QO.	1. 5–3. 5	0–9	Loam	ML	A–4
		9–26	Clay loam	CL	A–6 or A–4
		26	Sandstone or shale.		
Redona: Rd, RE, RF, Rg, Rh, Rk, RM, Rn, Ro, Rp.	>5	0–10	Fine sandy loam, loamy fine sand, or loam.	ML or SM	A–4 or A–2
		10–28	Sandy clay loam	SC or ML	A–4 or A–6
		28–68	Clay loam	CL	A–6 or A–4
Riverwash: Rr, RS. Too variable to be rated.					
Rock land: Rt, RU. Too variable to be rated.					
Rough broken and stony land, hilly: Rv, RW. Too variable to be rated.					
Rough broken and stony land, steep: Rx, RY. Too variable to be rated.					
San Jon: Sa, SB	1. 5–3. 5	0–8	Loam	ML	A–4
		8–26	Silty clay loam and gravelly clay loam.	CL, SC or ML	A–6 or A–4
		26	Shale.		
San Jose: Sc, SD	>5	0–60	Loam and fine sandy loam	SM or ML	A–4
Sharvana: SE	1–1. 5	0–16 16	Sandy loam and sandy clay loam Indurated caliche.	SC	A–6
*Springer: SF, SG, SH, SK, SM, SN For properties of the Amarillo soil in SF, see the Amarillo series.	>5	0–11	Loamy fine sand or fine sandy loam.	SM	A–2 or A–4
		11–36	Fine sandy loam	SM	A–4
		36–60	Loamy sand	SM	A–2

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm*		
10–30	90–100	85–95	80–90	25–35	2. 0–6. 3	0. 08–0. 10	7. 9–8. 4	0–1	Low	Low.
	100	100	60–70	30–40	2. 0–6. 3	0. 11–0. 13	7. 4–8. 4	0–1	Low	Low.
	100	100	50–75	15–30	2. 0–6. 3	0. 07–0. 09	7. 4–8. 4	0–1	Low	Low.
	100	100	90–100	70–90	0. 63–2. 0	0. 18–0. 20	7. 9–8. 4	0–1	Low	Low.
	100	100	90–100	75–95	<0. 06	0. 12–0. 14	7. 4–8. 4	2–8	High	High.
	100	100	85–95	60–75	0. 63–2. 0	0. 16–0. 18	6. 6–7. 3	0–1	Low	Low.
	100	100	90–100	70–85	0. 2–0. 63	0. 19–0. 21	7. 4–8. 4	0–1	Moderate	Moderate.
	100	100	80–90	45–60	0. 63–2. 0	0. 14–0. 16	7. 4–7. 8	0–1	Moderate	Modearte.
	80–95	70–90	60–85	50–70	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–1	Low	Low.
	100	100	90–100	40–60	0. 63–2. 0	0. 13–0. 18	7. 9–8. 4	0–1	Low	Low.
	100	100	90–100	50–70	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–1	Moderate	Moderate.
	100	100	90–100	50–70	0. 63–2. 0		7. 9–9. 0	0–1	Moderate	Moderate.
	100	100	90–100	50–60	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–1	Low	Low.
	100	100	90–100	50–70	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–1	Moderate	Moderate.
	100	100	90–100	30–60	0. 63–6. 3	0. 09–0. 18	7. 4–7. 8	0–1	Low	Low.
	100	100	90–100	45–65	0. 63–2. 0	0. 14–0. 16	7. 4–7. 8	0–1	Low to moderate.	Moderate.
	100	100	90–100	55–70	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–1	Moderate	Moderate.
	90–100	85–100	70–80	60–75	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	0–1	Low	Low.
	70–100	60–100	55–95	40–80	0. 20–0. 63	0. 14–0. 21	7. 4–9. 0	2–4	Moderate	Moderate.
	100	100	80–90	40–60	2. 0–6. 3	0. 13–0. 15	7. 4–8. 4	0–1	Low	Low.
	100	100	80–90	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	0–1	Low to moderate.	Moderate.
	100	100	75–85	20–50	2. 0–20. 0	0. 09–0. 15	6. 6–7. 3	0–1	Low	Low.
	100	100	80–90	35–50	2. 0–6. 3	0. 13–0. 15	7. 4–7. 8	0–1	Low	Low.
	100	100	75–85	15–25	6. 3–20. 0	0. 06–0. 08	7. 4–7. 8	0–1	Low	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols [1]	Depth to bedrock or cemented caliche	Depth from surface (typical profile)	Classification [2]		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Tivoli: TF	>5	0–60	Fine sand	SM	A–2
Toyah: Th, TK	>5	0–8	Loam	ML	A–4
		8–20	Sandy clay loam	SC	A–6
		20–60	Clay loam	CL	A–6
Tucumcari: Tm, TN, To	>5	0–60	Heavy clay loam and heavy silty clay loam.	CL	A–6 or A–7

[1] See soil descriptions in the section "Descriptions of the Soils" for information about kind of underlying rock and other detailed information about the soils.

TABLE 5.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear in

Soil series and map symbols	Suitability as a source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Amarillo: AL, AM, AR	Fair: fine sandy loam. Poor: loamy fine sand.	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 or A–6.	Fine-grained material; slight to medium plasticity.
*Bascom: BA, BB, BC, BD, BE, BF, BG, Bh. For the Bascom soil, nongravelly variant, in BE, and the Potter soil in BF, BG, and Bh, see the Bascom variant and the Potter series.	Poor: high in content of lime and gravel; subject to soil blowing.	Poor: fine sandy loam material.	Fair: caliche gravel.	Good to fair: A–1, A–2, and A–4.	Erodible when exposed on embankment; 0 to 9 percent slopes.
Bascom, variant: BK, BM	Fair: lime content in subsoil.	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 or A–6.	Medium plasticity

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm*		
	100	100	65–80	10–20	6. 3–20. 0	0. 05–0. 07	6. 6–7. 8	0–1	Low	Low.
	100	100	85–95	60–75	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–1	Low	Low.
	95–100	90–100	80–90	35–50	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	0–1	Moderate	Moderate.
	100	100	90–100	70–80	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–1	Moderate	Moderate.
	100	100	90–100	60–85	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	1–4	High	High.

[2] Soil layers high in carbonates may behave as if they were coarser textured.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully any instructions the first column of this table]

Soil features affecting—Continued			Degree and kind of limitation for—				Hydrologic soil group
Farm ponds		Terraces and diversions	Foundations for low buildings	Sanitary land fill	Septic tank absorption fields	Sewage lagoons	
Reservoir	Embankments						
Moderate permeability.	Medium shear strength; low compacted permeability; medium to low hazard of piping.	Moderate permeability; 0 to 3 percent slopes.	Low to moderate: low to moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Moderately rapid permeability; 0 to 9 percent slopes.	Medium shear strength; medium compacted permeability; medium hazard of piping.	Moderately rapid permeability; 0 to 9 percent slopes.	Slight	Slight	Slight	Severe: moderately rapid permeability.	B
Moderate permeability.	Medium shear strength; low compacted permeability; low to medium hazard of piping.	Moderate permeability; 0 to 3 percent slopes.	Low to moderate: low to moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Brownfield: BN, BO	Poor: coarse texture.	Fair to poor: sandy material to depth of about 18 to 24 inches.	Unsuitable: no gravel.	Good to fair: A–2 and A–4.	Erodible where exposed or where vegetation is cleared.
Canez: Ca, CB, Cc, Cd, Ce, CF.	Fair: fine sandy loam. Poor: loamy fine sand.	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair to poor: mostly A–4 and A–6.	Fine-grained material; slight to medium plasticity.
Canez, variant: Ch, Cl, Cn, CV	Poor: high in content of lime; subject to soil blowing.	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 and A–6.	Fine-grained material; slight to medium plasticity.
Dune land: DU	Poor: sand; hazard of soil blowing.	Good: poorly graded.	Unsuitable: no gravel.	Good: needs to be confined or to have soil binder added.	Very severe hazard of soil blowing; unstable unless confined; loose sand hinders hauling.
Gallegos: GA, Gg, GH, GI	Poor: high content of gravel.	Unsuitable: fine-grained and gravelly material.	Fair: very gravelly loam.	Good	Gently sloping to hilly topography.
Gomez: Gm, GN	Poor: coarse texture; hazard of soil blowing.	Poor: sandy loam below depth of 12 inches.	Unsuitable: no gravel.	Good to fair: A–2 and A–4.	Severe hazard of soil blowing.
Gullied land: GU	Poor: very severe hazard of erosion.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: fine-grained material; very severe hazard of erosion.	Very severe hazard of erosion; unstable material.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of limitation for—				Hydrologic soil group
Farm ponds		Terraces and diversions	Foundations for low buildings	Sanitary land fill	Septic tank absorption fields	Sewage lagoons	
Reservoir	Embankments						
Moderate permeability.	Medium shear strength; low compacted permeability; medium hazard of piping.	Moderate permeability; 0 to 3 percent slopes.	Slight	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	
Moderate permeability; 0 to 9 percent slopes.	Medium shear strength; low compacted permeability; medium to low hazard of piping.	Moderate permeability; 0 to 9 percent slopes.	Low to moderate: low to moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Moderate permeability	Medium shear strength; low compacted permeability; medium to low hazard of piping.	Moderate permeability; 0 to 9 percent slopes.	Low to moderate: low to moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Very rapid permeability.	Medium shear strength; high to medium compacted permeability; medium to high hazard of piping.	No applicable features.	Moderate: slopes; very severe hazard of soil blowing.	Severe: very rapid permeability.	Moderate: slope; possible pollution of water supply.	Severe: very rapid permeability; slope.	A
Moderately rapid permeabllity; 1 to 25 percent slopes.	Medium to high shear strength; medium compacted permeability; medium to low hazard of piping.	Moderately rapid permeability; 1 to 25 percent slopes.	Slight to severe: 1 to 25 percent slopes.	Moderate: high content of gravel; 1 to 25 percent slopes; moderately rapid permeability.	Slight: 1 to 8 percent slopes. Moderate: 8 to 15 percent slopes. Severe: 15 to 25 percent slopes.	Severe: moderately rapid permeability.	B
Moderately rapid permeability.	Medium shear strength; medium to low compacted permeability; medium to high hazard of piping.	Moderately rapid permeability; 0 to 3 percent slopes.	Slight	Slight	Slight	Severe: moderately rapid permeability.	B
Very severe hazard of erosion; vertical slopes on gully sides.	Medium to low shear strength; low compacted permeability; medium to high hazard of piping.	No applicable features.	Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.	Severe: moderately slow to very slow permeability; very severe hazard of erosion.	Severe: very severe hazard of erosion.	C

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Ima: Im, IN, Is	Fair: moderately coarse texture.	Poor: sandy loam and fine sandy loam.	Unsuitable: no gravel.	Good to fair: A–2 and A–4.	Features generally favorable.
Kinkead: KL, Km, Kn	Poor: clay loam and clay.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: A–7	Fine-grained material; high plasticity.
***Lacita:** La, LC, Ld, LE For the Gullied land part of LE, see Gullied land.	Poor: moderate to severe hazard of erosion.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Fair: A–4	Fine-grained material; moderate to severe hazard of erosion.
La Lande: Ll, Lm, LN, Lo, Lp, LR, Ls.	Good	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 and A–6.	Fine-grained material; medium plasticity.
Latom: Lt, LU, LV, LW	Poor: bedrock at depth of 6 to 18 inches.	Unsuitable: bedrock at depth of 6 to 18 inches.	Fair source for crushed rock.	Poor: bedrock at depth of 6 to 18 inches.	Bedrock at depth of 6 to 18 inches; 3 to 50 percent slopes.
Los Tanos: Lx, LY	Fair: sandy loam.	Poor: sandy loam; bedrock at depth of 18 to 42 inches.	Unsuitable: no gravel.	Poor: bedrock at depth of 18 to 42 inches.	Bedrock at depth of 18 to 42 inches.
Minneosa: Mn, MO	Poor: coarse texture; severe hazard of soil blowing.	Fair to poor: loamy sand.	Unsuitable: no gravel.	Good to fair: A–2 and A–4.	Subject to occasional flooding; loose sand hinders hauling.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of limitation for—				Hydrologic soil group
Farm ponds		Terraces and diversions	Foundations for low buildings	Sanitary land fill	Septic tank absorption fields	Sewage lagoons	
Reservoir	Embankments						
Moderately rapid permeability.	Medium shear strength; medium to low compacted permeability; medium to high hazard of piping.	Moderately rapid permeability; 1 to 5 percent slopes.	Slight	Slight	Slight	Severe: moderately rapid permeability.	B
Slow permeability	Low shear strength; low compacted permeability; low hazard of piping.	Slow permeability; 0 to 3 percent slopes.	Severe: high shrink-swell potential.	Severe: clay content.	Severe: slow permeability.	Slight	C
Moderately slow permeability.	Medium to low shear strength; low compacted permeability; medium to high hazard of piping.	Moderately slow permeability; 0 to 3 percent slopes.	Moderate: moderate shrink-swell potential.	Slight	Severe: moderately slow permeability.	Slight	B
Moderate permeability.	Medium to low shear strength; low to medium compacted permeability; medium hazard of piping.	Moderate permeability; 0 to 5 percent slopes.	Moderate: moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Bedrock at depth of 6 to 18 inches; 3 to 50 percent slopes.	Bedrock at depth of 6 to 18 inches.	No applicable features; bedrock at depth of 6 to 18 inches.	Severe: bedrock at depth of 6 to 18 inches.	Severe: bedrock at depth of 6 to 18 inches.	Severe: bedrock at depth of 6 to 18 inches.	Severe: bedrock at depth of 6 to 18 inches.	D
Bedrock at depth of 18 to 42 inches; moderately rapid permeability.	Medium shear strength; medium to low compacted permeability; medium to high hazard of piping.	No applicable features; bedrock at depth of 18 to 42 inches.	Moderate: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	C
Moderately rapid permeability.	Medium shear strength; medium to high compacted permeability; medium to high hazard of piping.	Moderately rapid permeability; 0 to 3 percent slopes.	Severe: occasional hazard of flooding.	Severe: occasional hazard of flooding.	Severe: occasional hazard of flooding.	Severe: moderately rapid permeability; occasional hazard of flooding.	B

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
*Montoya: MP, Mr, Ms, MT. For the Gullied land part of MT, see Gullied land.	Poor: clay	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: A–7	Subject to flooding; high plasticity; unstable material.
Olton: OT	Good	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: mostly A–6 and A–7.	Medium to high plasticity.
Potter: Po, PT	Poor: high content of caliche.	Unsuitable: mostly cemented caliche.	Fair: caliche gravel.	Poor: A–4; cemented caliche at depth of 6 to 12 inches.	Cemented caliche at depth of 6 to 12 inches; 1 to 9 percent slopes.
Quay: Qd, Qe, Qf, Qg, QH, Qk.	Fair: moderate content of lime.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 and A–6.	Fine-grained material; slight to medium plasticity.
Quay, sandstone and shale substratums: Ql, Qm, Qn, QO.	Fair: moderate content of lime.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: bedrock at depth of 18 to 42 inches.	Fine-grained material; bedrock at depth of 18 to 42 inches.
Redona: Rd, RE, RF, Rg, Rh, Rk, RM, Rn, Ro, Rp.	Good: loam. Fair: fine sandy loam. Poor: loamy fine sand.	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair to poor: A–4 and A–6.	Fine-grained material; slight to medium plasticity.
Riverwash: Rr, RS	Poor: high content of sand; subject to flooding.	Fair: contains some layers of fine-grained material.	Poor to fair: onsite selection needed.	Fair to good: subject to flooding.	Subject to flooding
Rock land: Rt, RU	Poor: rocks	Poor: no sand	Good source for crushed rock.	Poor: rocks	Rock outcrops; 20 to 80 percent slopes.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of limitation for—				Hydrologic soil group
Farm ponds		Terraces and diversions	Foundations for low buildings	Sanitary land fill	Septic tank absorption fields	Sewage lagoons	
Reservoir	Embankments						
Very slow permeability; subject to flooding.	Low shear strength; low compacted permeability; medium hazard of piping.	Very slow permeability; 0 to 3 percent slopes.	Severe: high shrink-swell potential; hazard of flooding.	Severe: high clay content; hazard of flooding.	Severe: very slow permeability.	Severe: hazard of flooding.	D
Moderately slow permeability.	Medium to low shear strength; low compacted permeability; low to medium hazard of piping.	Moderately slow permeability; 0 to 3 percent slopes.	Moderate: moderate shrink-swell potential.	Moderate: mostly clay loam texture.	Severe: moderately slow permeability.	Slight	C
Cemented caliche at depth of 6 to 12 inches; 1 to 9 percent slopes.	Bedrock at depth of 6 to 12 inches.	No applicable features; bedrock at depth of 6 to 12 inches.	Severe: cemented caliche at depth of 6 to 12 inches.	Severe: cemented caliche at depth of 6 to 12 inches.	Severe: cemented caliche at depth of 6 to 12 inches.	Severe: 1 to 9 percent slopes; cemented caliche at depth of 6 to 12 inches.	C
Moderate permeability; 0 to 9 percent slopes.	Medium to low shear strength; low compacted permeability; medium hazard of piping.	Moderate permeability; 0 to 9 percent slopes.	Moderate: moderate shrink-swell potential	Moderate: mostly clay loam texture.	Slight to moderate: moderate permeability.	Moderate to severe: moderate permeability; 0 to 9 percent slopes.	B
Bedrock at depth of 18 to 42 inches.	Bedrock at depth of 18 to 42 inches.	No applicable features; bedrock at depth of 18 to 42 inches.	Moderate: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.	C
Moderate permeability.	Medium shear strength; low compacted permeability; medium hazard of piping.	Moderate permeability; 0 to 5 percent slopes.	Slight to moderate: low to moderate shrink-swell potential.	Slight	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Rapid permeability; subject to flooding.	Medium shear strength; medium to high compacted permeability; medium to high hazard of piping.	No applicable features.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	
Rock outcrops; 20 to 80 percent slopes.	Too variable to rate.	No applicable features.	Severe: rock outcrops; 20 to 80 percent slopes.	Severe: rock outcrops; 20 to 80 percent slopes.	Severe: rock outcrops; 20 to 80 percent slopes.	Severe: rock outcrops; 20 to 80 percent slopes.	D

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Rough broken and stony land: Rv, RW, Rx, RY.	Poor: high content of stones; 9 to 75 percent slopes.	Unsuitable: no sand.	Fair: source for crushed stone.	Poor: stones; 9 to 75 percent slopes.	Stones hinder hauling and grading; 9 to 75 percent slopes.
San Jon: Sa, SB	Poor: severe hazard of erosion.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: bedrock at depth of 18 to 42 inches.	Shale at depth of 18 to 42 inches; medium plasticity.
San Jose: Sc, SD	Good	Unsuitable: mostly fine-grained material.	Unsuitable: no gravel.	Fair: A–4	Fine-grained material; slight plasticity.
Sharvana: SE	Poor: indurated caliche at depth of 12 to 18 inches.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: A–6; bedrock at depth of 12 to 18 inches.	Fine-grained material; indurated caliche at depth of 12 to 18 inches.
*Springer: SF, SG, SH, SK, SM, SN. For the Amarillo soil in SF, see the Amarillo series.	Poor to fair: severe to moderate hazard of soil blowing.	Fair: some fines	Unsuitable: no gravel.	Good to fair: A–2 and A–4.	Features generally favorable.
Tivoli: TF	Poor: fine sand; severe hazard of soil blowing.	Fair: fine sand texture.	Unsuitable: no gravel.	Good	Loose sand hinders hauling; severe hazard of soil blowing.
Toyah: Th, TK	Good	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: mostly A–6.	Fine-grained material; slight to medium plasticity.
Tucumcari: Tm, TN, To	Fair: clay loam and silty clay loam.	Unsuitable: fine-grained material.	Unsuitable: no gravel.	Poor: A–6 and A–7.	Fine-grained material; medium plasticity.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of limitation for—				Hydrologic soil group
Farm ponds		Terraces and diversions	Foundations for low buildings	Sanitary land fill	Septic tank absorption fields	Sewage lagoons	
Reservoir	Embankments						
Stones; 9 to 75 percent slopes.	Too variable to rate.	No applicable features.	Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.	Severe: 9 to 75 percent slopes.	Severe: 9 to 75 percent slopes.	
Shale at depth of 18 to 42 inches; slow permeability.	Bedrock at depth of 18 to 42 inches.	No applicable features; bedrock at depth of 18 to 42 inches.	Moderate: moderate shrink-swell potential; bedrock at depth of 18 to 42 inches.	Severe: clay loam and shale at depth of 18 to 42 inches.	Severe: moderately slow permeability; bedrock at depth of 18 to 42 inches.	Severe: slope; bedrock at depth of 18 to 42 inches.	C
Moderately rapid permeability.	Medium shear strength; medium to low compacted permeability; medium to high hazard of piping.	Moderately rapid permeability; 0 to 3 percent slopes.	Slight	Slight	Slight	Severe: moderately rapid permeability.	B
Indurated caliche at depth of 12 to 18 inches; moderate permeability.	Bedrock at depth of 12 to 18 inches.	No applicable features; bedrock at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.	D
Moderately rapid permeability.	Medium shear strength; medium to low compacted permeability; medium to high hazard of piping.	Moderately rapid permeability; 0 to 5 percent slopes.	Slight	Slight	Slight	Severe: moderately rapid permeability.	B
Rapid permeability.	Medium shear strength; medium to high compacted permeability; medium to high hazard of piping.	Rapid permeability; 3 to 25 percent slopes.	Slight: 3 to 8 percent slopes. Moderate: 8 to 15 percent slopes. Severe: 15 to 25 percent slopes.	Moderate: possible contamination of ground water.	Slight: 3 to 8 percent slopes. Moderate: 8 to 15 percent slopes. Severe: 15 to 25 percent slopes.	Severe: rapid permeability.	A
Moderate permeability.	Medium to low shear strength; low compacted permeability; low to medium hazard of piping.	Moderate permeability; 0 to 3 percent slopes.	Moderate: moderate shrink-swell potential.	Moderate: clay loam below depth of 18 to 24 inches.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Moderately slow permeability.	Medium to low shear strength; low compacted permeability; low to medium hazard of piping.	Moderately slow permeability; 0 to 3 percent slopes.	Severe: high shrink-swell potential.	Moderate: clay loam and silty clay loam.	Severe: moderately slow permeability.	Slight	B

TABLE 6.—*Engineering test data*

[Tests performed by the New Mexico State Highway Department in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Soil name and location	New Mexico report No.	Depth from surface	Liquid limit	Plasticity index	Mechanical analysis [1]			Classification	
					Percentage passing sieve—			AASHO	Unified
					No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)		
		Inches	*Percent*						
Ima sandy loam, 1 to 5 percent slopes:									
NW¼SW¼NE¼ sec. 14, T. 8 N., R. 32 E. (Modal)	65–254	4–13	[2] S	[3] NP	100	95	32	A–2–4(0)	SM
	65–255	13–36	S	NP	100	97	31	A–2–4(0)	SM
Lacita silt loam, 0 to 3 percent slopes:									
NE¼SE¼SW¼ sec. 16, T. 8 N., R. 28 E. (Modal)	65–235	8–24	S	NP	100	99	89	A–4(8)	ML
	65–236	24–36	S	NP	100	99	86	A–4(8)	ML
	65–237	36–48	31	10	100	99	94	A–4(8)	CL
La Lande loam, 0 to 5 percent slopes:									
0.4 mile south and 400 feet east of NW. corner of sec. 17, T. 9 N., R. 33 E. (Modal)	65–251	0–5	S	NP	100	99	78	A–4(8)	ML
	65–252	12–22	34	12	100	99	94	A–6(9)	CL
	65–253	22–42	25	8	100	99	96	A–4(8)	CL
Quay loam, 0 to 5 percent slopes:									
SE¼SE¼NE¼ sec. 31, T. 11 N., R. 31 E. (Modal)	65–257	0–5	S	NP	100	99	54	A–4(4)	ML
	65–258	5–18	30	11	100	95	54	A–6(4)	CL
	65–259	18–30	24	10	100	97	55	A–4(4)	CL
Redona fine sandy loam, 0 to 3 percent slopes:									
SW¼NE¼NE¼ sec. 24, T. 8 N., R. 30 E. (Modal)	65–248	0–6	S	NP	100	99	56	A–4(4)	ML
	65–249	14–26	S	NP	100	99	51	A–4(3)	ML
	65–250	36–50	30	10	100	99	56	A–4(4)	CL
Tucumcari clay loam, 0 to 3 percent slopes:									
800 feet south and 800 feet west of stock tank, SE¼SW¼ sec. 26, T. 8 N., R. 28 E. (Modal)	65–242	8–16	31	11	100	92	61	A–6(6)	CL
	65–243	30–49	33	12	100	98	85	A–6(9)	CL

[1] Analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soils.

[2] S=Sandy. [3] NP=Nonplastic.

Available water holding capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Reaction refers to the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Salinity affects the suitability of a soil for crops, its stability where used as a construction material, and its corrosiveness to other materials. Estimates of salinity are based on estimates of electrical conductivity of the saturated soil extract.

Shrink-swell potential is an indication of the volume change to be expected when the moisture content of soil material changes. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures built in, on, or with such material.

Corrosivity ratings in table 4 indicate the potential danger to untreated steel through chemical action that dissolves or weakens the structural material. Structural materials may corrode if buried in soil, and a given material corrodes in some kinds of soil more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

In this survey area small tracts of Montoya clay loam are subject to flooding.

Engineering interpretations

Table 5 gives estimates of the suitability of the soils for specified uses and lists soil properties that affect construction of highways, farm facilities, buildings, and sewage-disposal systems. Detrimental or undesirable features are emphasized, but some very important desirable

features also are listed. The ratings and other interpretations in this table are based on the estimated engineering properties of the soils given in table 4; on available test data, including those given in table 6; and on field experience. The information is reasonably reliable to a depth of about 6 feet for most soils and to greater depths for some.

Topsoil is fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

The ratings for sand and gravel are based on the probability that delineated areas of the soil contain deposits of sand and gravel. The ratings do not indicate the precise quality or the size of the deposits.

Road fill is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for this purpose.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features listed, both favorable and unfavorable, are the principal features that affect the geographic location of highways.

Farm pond reservoir areas are affected mainly by loss of water through seepage. The soil features listed are those that influence such seepage. Farm pond embankments serve as dams. The soil features of both the subsoil and the substratum are those important to the use of soils for constructing embankments.

Terraces and diversions are low structures designed to retain or divert water. The soil features listed in table 5 are those that affect the use of the soil as material for such structures.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence its capacity to support low buildings having normal foundation loads.

Sanitary land fills are dumping grounds for refuse collected from towns and cities. They are often constructed by excavating pits that are subsequently filled with refuse. It is important to keep in mind that refuse-filled land is generally poorly suited to supporting structures, since decomposition within the fill may cause land subsidence.

Septic tank absorption fields and sewage lagoons are affected mainly by permeability, hazard of erosion, susceptibility to flooding, depth to bedrock, and slope.

Hydrologic soil groups are used in watershed planning to estimate runoff from rainfall. A hydrologic soil group consists of soils having similar rates of infiltration by water, even when wetted, and similar rates of water transmission within the soil. Soil properties are considered that influence the minimum rate of infiltration obtained for a bare soil after prolonged wetting. These properties are depth to the seasonal high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The influence of ground cover is treated independently, not in the hydrologic soil groups.

GROUP A has a low runoff potential. Soils of this group have high infiltration rates even when throughly wetted. The soils are chiefly deep, well-drained to excessively drained sands and gravels. These soils have a high rate of water transmission.

GROUP B has a moderately low runoff potential. Soils of this group have moderate infiltration rates when thoroughly wetted. The soils are chiefly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. These soils have a moderate rate of water transmission.

GROUP C has a moderately high runoff potential. Soils of this group have slow infiltration rates when thoroughly wetted. The soils are chiefly those that have a layer that impedes downward movement of water, have moderately fine to moderately coarse texture, or have a water table at a moderate depth. These soils may be somewhat poorly drained.

GROUP D has a high runoff potential. Soils of this group have slow infiltration rates when thoroughly wetted. The soils are chiefly clays that have a high swelling potential, a permanent high water table, and a claypan or other clay layer at or near the surface. Also in Group D are soils shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The suitability of soils for winter grading varies from year to year, depending on the moisture content of the soil and the temperature during winter. During some winters, soil moisture is low and little frost forms in the soil. When temperature permits, moisture can be added to provide proper conditions for earth construction. In those winters when soil moisture is high and temperatures are extreme for extended periods, earth movement in most places is postponed.

At many construction sites, major soil variations occur within the depth of a proposed excavation and several soil units can be encountered within a short distance. The soil map and profile descriptions, as well as the engineering data given in this section, can be used in planning detailed surveys of soils at construction sites. Using the information in the soil survey enables the soils engineer to concentrate on the most suitable soil units. Then a minimum number of soil samples are required for laboratory testing, and an an adequate soil investigation can be made at minimum cost.

Engineering test data

Table 6 contains the results of engineering tests performed by the New Mexico State Highway Department on several important soils in the Tucumcari Area. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant to engineering.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry condition, the material changes from a semi-solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which

the soil material passes from semisolid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Mechanical analysis shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and coarser materials do not pass through the No. 200 sieve, but silt and clay do. Silt particles are those larger than 0.002 millimeter in diameter that pass through the No. 200 sieve. Clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method rather than the pipette method.

Use of the Soils for Community and Recreational Development

Each year more farmland in the Tucumcari Area is converted to nonfarm uses. In this subsection such uses are discussed, and information is given to aid planners, developers, and others concerned with using soils for the layout and construction of subdivisions, streets, landscaped areas, and sites for recreation. Newcomers, particularly those seeking living accomodations in the Area, will also be interested in this information. Additional information helpful for the purposes discussed here can be gotten from the section "Engineering Uses of the Soils."

Generally, the soils and climate of the Tucumcari Area are well suited to a wide range of recreational activities. These activities include hunting, camping, fishing, boating, swimming, horseback riding, hiking, picnicking, and sightseeing. Ute Reservoir, a good and popular recreational site, is easily accessible from anywhere in the Area. Tucumcari, the "legendary city," has much colorful and interesting natural scenery that is enjoyable to see and photograph. These and other parts of the Area are well suited to nature trails.

In table 7 the soils of the Area are evaluated for selected uses in community development and recreation. The degree of their limitation for such uses and the soil features responsible are given. Information in the table can help avoid costly errors and unnecessary changes in planning. This information, however, along with that available in other sections and the soil maps, is intended only to provide guidelines. It does not supplant information derived from the actual, direct, and detailed onsite investigation necessary for any planned development.

The soils have been rated only to a depth of 5 feet or less. The degree of limitation of soils for a specified use is given as slight, moderate, or severe. A *slight* rating indicates that the limitations are few or easy to overcome. A *moderate* rating indicates that the limitations can be overcome through careful design and good management. A *severe* rating indicates that the limitations are such as render this use of the soils questionable. The following paragraphs give the uses for which the soils

TABLE 7.—*Limitations of the soils for selected*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear

Soil series and map symbols	Degree and kind of limitation for—		
	Community development		
	Homesites	Streets and parking lots in subdivisions	Excavations
Amarillo: AL, AM, AR	Slight to moderate: low to moderate shrink-swell potential.	Moderate: SC and CL	Slight
*Bascom: BA, BB, BC, BD, BE, BF, BG, Bh. For the Bascom soil, nongravelly variant, in BE, and the Potter soil in BF, BG, and Bh, see Bascom series, nongravelly variant, and the Potter series.	Slight	Slight	Moderate: high content of caliche gravel below depth of 18 inches.
Bascom, nongravelly variant: BK, BM	Slight to moderate: low to moderate shrink-swell potential.	Moderate: SC and CL	Slight
Brownfield: BN, BO	Moderate: subject to soil blowing.	Slight	Moderate: material to depth of 24 inches subject to slumping.
Canez: Ca, CB, Cc, Cd, Ce, CF	Slight to moderate: low to moderate shrink-swell potential.	Moderate: SC and CL	Slight

are rated in table 7 and the soil features mostly affecting them.

Homesites are affected mostly by stability of soils for supporting low buildings and suitability of soils for onsite sewage disposal and for landscaping. The main soil features considered are shrink-swell potential, depth to bedrock, hazard of flooding, slope, hazard of erosion, and stoniness and rockiness.

Streets and parking lots in subdivisions are affected by features of undisturbed soils that influence construction and maintenance. The main soil features considered are shrink-swell potential, depth to bedrock, topography, slope, texture, hazard of flooding, hazard of erosion, and stoniness and rockiness. The Unified system symbols given are explained in the subsection "Engineering soil classification systems."

Excavations are mostly required for underground utilities installations and basements. The principal soil features considered are depth to bedrock, incidence of slumping, texture, hazard of flooding, content of gravel, and stoniness and rockiness.

Lawns, landscaping, and golf fairways are affected mostly by suitability of soils for adapted grasses and shrubs. Most species that are planted require irrigation, but native grasses and shrubs do not. The main soil features considered are available water holding capacity, hazard of erosion, depth to bedrock, content of lime, permeability, slope, content of gravel, and stoniness and rockiness.

Camp areas are used for tent sites, smaller trailer parking sites, and other outdoor living activities. Little preparation is required apart from shaping and leveling where needed. Ratings do not reflect suitability of soils in these areas for vegetation, but this factor should be investigated when selecting campsites. The soil features considered are mainly hazard of erosion, hazard of flooding, slope, consistence when wet, content of gravel, and stoniness and rockiness.

Picnic areas are mostly in places where soils need not be altered from their natural state. Such facilities as tables and grills are present for use at most sites. The soil features considered are mainly depth to bedrock, hazard of erosion, texture of surface layer incident to erosion, slope, hazard of flooding, consistence when wet, content of gravel, and stoniness and rockiness.

Playgrounds are used for tennis courts, baseball fields, and other play and game areas. Because such areas must be level or nearly level, heavy grading or shaping is necessary in places. Thus, all major soil properties must be considered when selecting sites. The main soil features considered in the table are depth to bedrock, hazard of erosion, texture of suface layer incident to erosion, slope, hazard of flooding, permeability, consistence when wet, content of gravel, and stoniness and rockiness.

Paths and trails are used for horseback riding, hiking, walking, and related activities. Generally, little preparation is required, and the soils need not be altered from their natural state. The main soil features considered are topography, hazard of erosion, slope, hazard of flooding, consistence when wet, and stoniness and rockiness.

uses in community development and recreation

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully any instruction in the first column of this table]

Degree and kind of limitation for—Continued				
Community development—Continued	Recreation			
Lawns, landscaping, and golf fairways	Camp areas	Picnic areas	Playgrounds	Paths and trails
Slight	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Slight.
Moderate: very low available water holding capacity; high content of lime.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Severe: high content of caliche gravel below depth of 18 inches.	Slight.
Slight	Slight	Slight	Slight	Slight.
Moderate: severe hazard of soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: severe hazard of soil blowing.
Slight	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing; 0 to 9 percent slopes.	Slight.

TABLE 7.—*Limitations of the soils for selected*

Soil series and map symbols	Degree and kind of limitation for—		
	Community development		
	Homesites	Streets and parking lots in subdivisions	Excavations
Canez, calcareous variant: Ch, CI, Cn, CV	Slight to moderate: low to moderate shrink-swell potential.	Moderate: SC and CL	Slight
Dune land: DU	Severe: very severe hazard of soil blowing.	Moderate: very severe hazard of soil blowing; rolling topography.	Severe: subject to slumping.
Gallegos: GA, Gg, GH, GI	Slight to severe: 1 to 25 percent slopes.	Slight to severe: 1 to 25 percent slopes.	Moderate to severe: high content of gravel.
Gomez: Gm, GN	Slight	Slight	Slight
Gullied land: GU	Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.	Severe: vertical cuts on gully sides.
Ima: Im, IN, Is	Slight	Slight	Slight
Kinkead: KL, Km, Kn	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: clay and clay loam.
*Lacita: La, LC, Ld, LE For the Gullied land part of LE, see Gullied land.	Moderate: moderate shrink-swell potential.	Moderate: moderate to severe hazard of erosion.	Slight
La Lande: LI, Lm, LN, Lo, Lp, LR, Ls	Moderate: moderate shrink-swell potential.	Moderate: mostly CL	Slight
Latom: Lt, LU, LV, LW	Severe: bedrock at depth of 6 to 18 inches.	Severe: bedrock at depth of 6 to 18 inches; 3 to 50 percent slopes.	Severe: bedrock at depth of 6 to 18 inches.
Los Tanos: Lx, LY	Moderate: bedrock at depth of 18 to 42 inches.	Moderate: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.
Minneosa: Mn, MO	Severe: subject to occasional flooding.	Severe: subject to occasional flooding.	Severe: subject to slumping.
*Montoya: MP, Mr, Ms, MT For the Gullied land part of MT, see Gullied land.	Severe: subject to flooding; high shrink-swell potential.	Severe: subject to flooding; high shrink-swell potential.	Severe: clay; subject to flooding.
Olton: OT	Moderate: moderate shrink-swell potential.	Severe: CL	Moderate: mostly clay loam.
Potter: Po, PT	Severe: cemented caliche at depth of 6 to 12 inches.	Severe: cemented caliche at depth of 6 to 12 inches.	Severe: cemented caliche at depth of 6 to 12 inches.

uses in community development and recreation—Continued

Degree and kind of limitation for—Continued				
Community development—Continued	Recreation			
Lawns, landscaping, and golf fairways	Camp areas	Picnic areas	Playgrounds	Paths and trails
Moderate: subject to soil blowing; high content of lime.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing; 0 to 9 percent slopes.	Slight.
Severe: very severe hazard of soil blowing.	Severe: very severe hazard of soil blowing.	Severe: very severe hazard of soil blowing.	Severe: very severe hazard of soil blowing.	Moderate: very severe hazard of soil blowing; rolling topography.
Severe: high content of gravel; very low available water holding capacity.	Moderate to severe: high content of gravel; 1 to 25 percent slopes.	Moderate to severe: high content of gravel; 1 to 25 percent slopes.	Severe: high content of gravel; 1 to 25 percent slopes.	Slight to moderate: 1 to 25 percent slopes.
Moderate: high content of lime; low available water holding capacity.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Slight.
Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.	Severe: very severe hazard of erosion.
Moderate: moderate to severe hazard of soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing; 1 to 5 percent slopes.	Slight.
Slight	Moderate: sticky when wet.	Moderate: sticky when wet.	Moderate: sticky when wet.	Slight.
Slight	Slight	Slight	Slight to moderate: 0 to 3 percent slopes.	Slight.
Slight	Slight	Slight	Slight to moderate: 0 to 5 percent slopes.	Slight.
Severe: bedrock at depth of 6 to 18 inches; 3 to 50 percent slopes.	Severe: stony; bedrock at depth of 6 to 18 inches.	Severe: stony	Severe: bedrock at depth of 6 to 18 inches; 3 to 50 percent slopes.	Moderate: stony.
Moderate: very low available water holding capacity.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Severe: bedrock at depth of 18 to 42 inches; 1 to 5 percent slopes.	Slight.
Severe: severe hazard of soil blowing.	Severe: subject to occasional flooding.	Moderate: subject to occasional flooding.	Severe: subject to occasional flooding.	Moderate: subject to occasional flooding.
Moderate: very slow permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Slight	Slight	Slight	Moderate: moderately slow permeability.	Slight.
Severe: cemented caliche at depth of 6 to 12 inches.	Slight	Slight	Moderate: 1 to 9 percent slopes.	Slight.

TABLE 7.—*Limitations of the soils for selected*

Soil series and map symbols	Degree and kind of limitation for—		
	Community development		
	Homesites	Streets and parking lots in subdivisions	Excavations
Quay: Qd, Qe, Qf, Qg, QH, Qk	Moderate: moderate shrink-swell potential.	Moderate to severe: CL.	Moderate: mostly clay loam.
Quay, sandstone and shale substratums: Ql, Qm, Qn, QO.	Moderate: bedrock at depth of 18 to 42 inches.	Moderate: bedrock at depth of 18 to 42 inches.	Severe: bedrock at depth of 18 to 42 inches.
Redona: Rd, RE, RF, Rg, Rh, Rk, RM, Rn, Ro, Rp	Slight to moderate: low to moderate shrink-swell potential.	Moderate: SC, ML and CL.	Slight
Riverwash: Rr, RS	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Rock land: Rt, RU	Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.
Rough broken and stony land: Rv, RW, Rx, RY	Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.
San Jon: Sa, SB	Moderate: moderate shrink-swell potential; shale at depth of 18 to 42 inches.	Moderate: moderate shrink-swell potential; shale at depth of 18 to 42 inches.	Moderate: clay loam; shale at depth of 18 to 42 inches.
San Jose: Sc, SD	Slight	Moderate: SM or ML	Slight
Sharvana: SE	Severe: indurated caliche at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.	Severe: indurated caliche at depth of 12 to 18 inches.
*Springer: SF, SG, SH, SK, SM, SN. For the Amarillo soil in SF, see the Amarillo series.	Slight	Slight	Slight
Tivoli: TF	Moderate to severe: hazard of soil blowing; 3 to 25 percent slopes.	Slight to severe: 3 to 25 percent slopes.	Severe: subject to slumping.
Toyah: Th, TK	Moderate: moderate shrink-swell potential.	Moderate: SC and CL	Moderate: clay loam
Tucumcari: Tm, TN, To	Severe: high shrink-swell potential.	Severe: CL	Moderate: clay loam and silty clay loam.

uses in community development and recreation—Continued

Degree and kind of limitation for—Continued				
Community development—Continued	Recreation			
Lawns, landscaping, and golf fairways	Camp areas	Picnic areas	Playgrounds	Paths and trails
Slight	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 9 percent slopes.	Slight.
Moderate: high content of lime; bedrock at depth of 18 to 42 inches.	Slight	Slight	Moderate to severe: bedrock at depth of 18 to 42 inches; 0 to 5 percent slopes.	Slight.
Slight to moderate: hazards of soil blowing and water erosion.	Slight to moderate: loamy fine sand is subject to soil blowing.	Slight to moderate: loamy fine sand is subject to soil blowing.	Slight to moderate: loamy fine sand is subject to soil blowing; 0 to 5 percent slopes.	Slight.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.	Severe: rocky; 20 to 80 percent slopes.
Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.	Severe: stony; 9 to 75 percent slopes.	Moderate to severe: stony; 9 to 75 percent slopes.
Moderate: shale at depth of 18 to 42 inches.	Slight	Slight	Moderate: shale at depth of 18 to 42 inches; 1 to 5 percent slopes.	Slight.
Slight	Slight	Slight	Slight	Slight.
Moderate: very low available water holding capacity.	Slight	Slight	Severe: indurated caliche at depth of 12 to 18 inches.	Slight.
Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing.	Moderate: subject to soil blowing; 0 to 9 percent slopes.	Slight.
Severe: severe hazard of soil blowing; very low available water holding capacity.	Moderate to severe: subject to soil blowing; 3 to 25 percent slopes.	Moderate to severe: subject to soil blowing; 3 to 25 percent slopes.	Moderate to severe: subject to soil blowing; 3 to 25 percent slopes.	Moderate: subject to soil blowing; 3 to 25 percent slopes.
Slight	Slight	Slight	Slight	Slight.
Slight	Moderate: sticky when wet.	Moderate: sticky when wet.	Moderate: sticky when wet.	Moderate: sticky when wet.

Formation and Classification of the Soils

The major factors of soil formation are described in this section, and the way they relate to the soils of the Tucumcari Area is explained. Also briefly described here is the current system of classifying soils into categories broader than series. The soils of the Area are then classified according to that system.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on material deposited or accumulated by geologic agencies. Characteristics of the soil at any given point are determined by five factors. These are the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil genesis. They act on parent material that has accumulated through weathering of rocks and slowly change it into a natural formation having genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme instances, determines it almost entirely. Time is essential for the parent material to change into a soil profile. Whether great or small, some length of time always is required for the various kinds of horizons to form. A long time is normally required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on soil that few generalizations can be made regarding the effect of any one of them unless conditions are specified for the other four. In addition, many of the processes of soil formation are yet unknown.

Parent material

Parent material is the weathered rock or unconsolidated material from which soils form. The hardness, grain size, and porosity of parent material and its content of weatherable minerals greatly influence the formation of soils. Four main sources of parent material are in the Tucumcari Area: alluvium, wind-laid sediment, caliche, and bedrock. These sources are described in the following paragraphs.

The largest areas of soils are those formed in alluvium deposited in the erosional valley of the Canadian River and its tributaries. This river has cut through the formations of five major geologic periods: the Triassic, Jurassic, and Cretaceous, and the Tertiary and Quarternary (*4*, *8*).

Recent alluvium consists of relatively unweathered sediment deposited during recent geologic time on alluvial fans and flood plains. The deposits on alluvial fans from Triassic red beds are silty. Lacita soils formed in this silty alluvium. A few minor streams have deposited mixed recent alluvium along the margin of the High Plains. Toyah soils formed in this material. The deposits on flood plains and fans from Triassic and Cretaceous sandstone and siltstone are generally moderately coarse textured or coarse textured. San Jose soils formed in the moderately coarse textured alluvium, and Minneosa soils formed in the coarse-textured alluvium on flood plains and low terraces.

Young alluvium was deposited earlier than recent alluvium during the Quaternary period. Most areas of young alluvium are not subject to further deposition by flooding. The deposits from Triassic red-bed shale on broad alluvial fans are mostly fine textured. Montoya soils formed in this fine-textured alluvium. La Lande and Quay soils formed in medium to moderately fine textured young alluvium deposited from Triassic red-bed shale and sandstone. Ima soils formed in moderately coarse textured alluvium deposited from Triassic red-bed sandstone and siltstone. Gomez soils formed in calcareous, moderately coarse textured alluvium deposited in alluvial basins on the High Plains. Gravelly alluvium was deposited along the Canadian River, Ute Creek, and some other major streams in the Tucumcari Area. Gallegos soils formed in this gravelly alluvium on remnants of high terraces.

Old alluvium in the Canadian River erosional valley was probably deposited during Pleistocene time (*8*) on broad alluvial fans. Kinkead and Tucumcari soils formed in old, moderately fine textured alluvium. They have a distinct clayey subsoil and a higher content of lime in the lower part of the subsoil. Canez and Redona soils formed in medium to moderately coarse textured alluvium. The carbonates have leached from the surface layer and subsoil of these soils, which now have a distinct sandy clay loam subsoil.

Old alluvium on the High Plains was probably deposited during Pliocene time on coalescing alluvial fans from mountain streams (*4*). Olton and Amarillo soils formed in this old alluvium. They are noncalcareous in the surface layer and upper part of the subsoil but have a distinct layer of lime accumulation below. They also have a distinct increase of clay in the subsoil.

Brownfield and Springer soils formed in old sandy alluvium that was reworked by wind.

Wind-laid sediment consists mostly of sand and some silt that have been deposited in the form of dunes. Tivoli soils formed in this sandy wind-laid sediment. In a few places silty wind-laid sediment (loess) has been deposited over beds of caliche. Sharvana soils formed in this material.

Caliche consists of hard, thick beds of gravel, sand, and silt cemented by secondary calcium carbonate. Potter soils formed in beds of fractured cemented caliche. Bascom soils formed in mixed caliche gravel and in alluvial and wind-laid sediment.

Bedrock in the Tucumcari Area is all sedimentary rock. Latom and Los Tanos soils formed in residuum from Cretaceous, Jurassic, and Triassic sandstone. San Jon soils formed in residuum from Triassic red-bed shale, siltstone, and sandstone.

Climate

The Tucumcari Area has a semiarid, continental type of climate. Summer days are hot but nights are cool. Winters are mild, sunny, and dry. About 77 percent of the 16

inches of average annual precipitation falls in the period of May through September. In general, precipitation increases by about one inch for each 50 miles in the Area from west to east.

Plant growth, mostly grasses and shrubs, is generally delayed until the summer rains begin in May. The plants stop growing when frost occurs in autumn or when available moisture is all gone. The oxidation of organic matter during the hot summers and the limited plant growth permit little accumulation of organic matter.

Moisture from precipitation does not move completely through the profile of soils in the Tucumcari Area. Calcium carbonate has leached downward from the surface layer and upper part of the subsoil in many soils. Examples of this are the Canez and Amarillo soils. An increase in calcium carbonate below the subsoil indicates that moisture can penetrate to that depth.

Clay has built up in the subsoil of the fine-textured Kinkead and Olton soils. Moisture soaking into the soil has carried clay particles from the surface layer into the subsoil.

The strong winds of the Area have been responsible for formation of the Tivoli soils. Wind has blown the sand from stream channels and deposited it in undulating to rolling topography characteristic of the sand hills in the Area.

Plant and animal life

Vegetation is the dominant component of this soil-forming factor in the Tucumcari Area. Other important components are fungi, bacteria, earthworms, and rodents. Such plant and animal life provides organic matter and brings plant nutrients from lower to upper horizons in the soils.

When the first settlers arrived, the Tucumcari Area was a vast grassland. Open stands of mid and tall grasses were predominant on the sandy soils, and open stands of short and mid grasses were predominant on the loamy and clayey soils. Denser stands of grass grew on soils that received extra runoff. Many of the soils in the Area even yet have light-colored surface layers low in organic matter. Kinkead and Olton soils have a darkened surface layer that is about 2 percent organic matter. They have more organic matter because of the greater plant residue that resulted from denser vegetation. Toyah soils received more moisture from extra runoff and were also capable of growing more vegetation; thus, they too are higher in content of organic matter.

Earthworms feed on organic matter and thoroughly mix the soils in which they live. The process is further aided by gophers, prairie dogs, kangaroo rats, and badgers that burrow deep into the ground and spread soil from their diggings over the surface. The abandoned burrows soon fill with soil from the surface layer, which allows easy penetration by plant roots.

Relief

Differences in relief influence the rate of erosion, surface runoff, percolation of water, and vigor of plant growth in soils. These differences are reflected in thickness of the surface layer and its content of organic matter, depth of the solum, degree of horizon differentiation, and nature of the parent material.

Latom and Los Tanos soils formed in residuum weathered from sandstone. In the Latom soils slopes are 3 to 50 percent, surface runoff is medium to rapid, and bedrock is at a depth of 6 to 20 inches. In the Los Tanos soils slopes are 1 to 5 percent, surface runoff is slow to medium, and bedrock is at a depth of 20 to 40 inches. The difference in slope gradient between the two soils has resulted in differences in amount of surface runoff and rate of erosion, which in turn account for the shallower depth to bedrock of Latom soils.

Kinkead and Tucumcari soils are geographically associated in a regular pattern. The Kinkead soils are on concave aluvial fans, and the Tucumcari soils are on slightly concave to slightly convex fans. As a result, Kinkead soils receive slightly more moisture, have denser vegetation, and contain more organic matter than Tucumcari soils, and are leached of carbonates to a depth of about 19 inches.

Time

The length of time necessary for a soil to form from parent material depends on effects of the other soil-forming factors. Older soils have distinct soil horizons that reflect the movement of clay from the surface layer down into the subsoil, the leaching of calcium carbonates, and the formation of structure. Such soils have approached equilibrium with their environment. Younger soils reveal their youth through a lack of distinct horizons.

In the Tucumcari Area Olton soils are probably oldest. These soils formed in old alluvium deposited in Pliocene time and reworked by wind during Pleistocene time. The surface layer has been darkened by accumulation of organic matter. Water percolating through the profile has moved clay from the surface and deposited it in the subsoil. Calcium carbonates have leached downward. Deposits of these carbonates have increased slightly in the lower part of the subsoil and accumulated in larger amounts below. Moderate prismatic and subangular blocky structure has formed in the subsoil.

San Jon soils are young, and overlie weathering shale and sandstone at a depth of 20 to 40 inches. Because of active erosion, weathering of these soils has nearly kept pace with that of the shale parent material.

Minneosa soils are young soils that formed in stratified, calcareous sandy alluvium. These soils retain most of the characteristics of their parent material, except that the surface layer is very slightly darker.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and revised later (*7*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and adopted in 1965 (*9*). It is under continual study (*6, 9*).

The current system of classification is a comprehensive one designed to accommodate all soils. It has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. Soils that are similar in important characteristics are grouped in each category of the system. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series in the Tucumcari Area by family, subgroup, and order, according to the current system. Beginning with the most inclusive, five categories of the system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mostly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. Absence of such horizons is also a factor in classification. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil proper-

TABLE 8.—*Classification of soil series by higher categories according to current system*

Series	Family	Subgroup	Order
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Bascom	Loamy-skeletal, carbonatic, thermic.	Ustollic Calciorthids	Aridisols.
Bascom, nongravelly variant	Fine-loamy, mixed, thermic	Ustollic Calciorthids	Aridisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Canez	Fine-loamy, mixed, thermic	Ustollic Haplargids	Aridisols.
Canez, calcareous variant	Fine-loamy, carbonatic, thermic	Ustollic Calciorthids	Aridisols.
Gallegos	Loamy-skeletal, mixed, thermic	Ustollic Camborthids	Aridisols.
Gomez	Coarse-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Ima	Coarse-loamy, mixed, thermic	Ustochreptic Camborthids	Aridisols.
Kinkead	Fine, mixed, thermic	Aridic Argiustolls	Mollisols.
Lacita	Fine-silty, mixed (calcareous), thermic.	Ustic Torriorthents	Entisols.
La Lande	Fine-loamy, mixed, thermic	Ustollic Camborthids	Aridisols.
Latom	Loamy, mixed (calcareous), thermic.	Lithic Ustic Torriorthents	Entisols.
Los Tanos	Coarse-loamy, mixed, thermic	Ustochreptic Camborthids	Aridisols.
Minneosa	Sandy, mixed, thermic	Ustic Torrifluvents	Entisols.
Montoya	Fine, mixed, thermic	Mollic Torrerts	Vertisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Potter	Loamy, carbonatic, thermic, shallow.	Ustollic Calciorthids	Aridisols.
Quay	Fine-silty, mixed, thermic	Ustochreptic Calciorthids	Aridisols.
Redona	Fine-loamy, mixed, thermic	Ustollic Haplargids	Aridisols.
San Jon	Fine-loamy, mixed, thermic	Ustollic Calciorthids	Aridisols.
San Jose	Coarse-loamy, mixed (calcareous), thermic.	Ustic Torriorthents	Entisols.
Sharvana	Loamy, mixed, thermic, shallow	Petrocalcic Ustalfic Paleargids	Aridisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Toyah	Fine-loamy, mixed, thermic	Fluventic Haplustolls	Mollisols.
Tucumcari	Fine, mixed, thermic	Ustollic Haplargids	Aridisols.

ties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Ustochrepts (a typical Ustochrept).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and soil consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the fine-loamy, carbonatic, thermic family of Ustollic Calciorthids.

General Nature of the Area

This section contains general information about the farming and irrigation history of the Tucumcari Area. Following this, climate is discussed in detail, based on information from the U.S. Department of Commerce and New Mexico State University.

Farming and Irrigation History

In the late nineteenth and early twentieth centuries, the Tucumcari Area was mostly cattle country. Farming came to the Area along with the Rock Island Railroad, which was built in the period 1901 to 1910. Homesteaders soon plowed a great many acres of the soil, but because of their limited knowledge, experience, and capabilities, few of them were successful farmers. Consequently, some of their farms were taken over by more competent individuals, but many were simply abandoned. The barren and severely eroded fields that are now completely unsuitable for farming bear witness to these early failures.

In December 1938 agreement was reached between the Arch Hurley Conservancy District and the Bureau of Reclamation, and approval was given for the building of a canal and water distribution system in the Tucumcari Area. Construction began in 1940 but was suspended by the War Production Board in December 1942. It was officially resumed in April 1944 as a War Emergency Food Project. Irrigation water was first delivered to areas within the project in 1946, and construction was completed in 1950. These areas are now known as the Arch Hurley Irrigation Project, and the delivery system as the Conchas Canal.

Conchas Canal extends from Conchas Dam to a point about 7 miles southeast of the town of Tucumcari. It is 84 miles in length and about 24 feet in width at the bottom. Water depth is 9 feet. Diversion capacity is 700 cubic feet per second. The canal includes 5 tunnels having a total length of 30,370 feet and 31 concrete siphons having a total length of 21,921 feet.

A secondary canal, known as the Hudson Canal, is about 1 mile south of the town of Tucumcari. It extends to the northeast for a distance of about 26 miles.

Areas of soils within the Arch Hurley Irrigation Project are used to grow such irrigated crops as alfalfa, grain sorghum, cotton, wheat, and, to a limited extent, silage corn, tomatoes and other vegetables and melons. Areas used for dryfarming are mostly near the communities of Porter and Norton, where the principal dryfarmed crops grown and harvested are broomcorn, wheat, and grain sorghum.

Climate [6]

The Tucumcari Area has a semiarid, continental type of climate characterized by distinct seasonal and wide diurnal temperature changes, low humidity, and generally clear skies.

Summers are warm. Temperatures exceed 90° F. on an average of 80 days a year, and 100° on an average of 10 days a year. They fall rapidly after sunset, however, and average in the low sixties in most nights. The drop is generally accompanied by a low relative humidity, with the result that most summer nights are comfortably cool. Winters are mild, sunny, and dry. Daytime temperatures generally rise to about 50°. They remain at or below the freezing point on an average of only 7 days a year. Freezing temperatures normally occur at night from the middle of November to the middle of March. Temperatures of zero or below occur on an average of only once a year.

Table 9 and the two graphs in figure 20 summarize temperature and precipitation data for the town of Tucumcari. The data are based on measurements made at the Northeastern Substation of New Mexico State University, about 3 miles northeast of the city center, for the period 1931 through 1960 (*12*).

Data in the table are generally representative for the Tucumcari Area, except that temperatures at lower elevations in the northeast are normally a little higher during the day and a little lower during the night. The highest temperature recorded in the Area was 112° at Obar in July 1933; the lowest was −20° at Obar in January 1959 and at an earlier date.

The graphs give probabilities of specified temperatures on indicated calendar dates in spring and in autumn [fig. 20]. The probabilities are for indicated temperatures or lower. The temperatures may occur on an indicated date as well as after or before that date. To use the graphs, select the temperature line of interest, follow to the point of intersection with the calendar date desired, and read the percentage probability of that temperature occurring after [before] that date on the vertical scale. The average length of the period between the last temperature of 32° or lower in spring and the first temperature of 32° or lower in autumn is about 190 days.

Average annual precipitation in the Tucumcari Area is about 14 to 16 inches. Summer is the rainy season. About 77 percent of the total annual rainfall occurs in the period of May through September. It is mostly in the form of occasionally heavy afternoon thunderstorms that have derived their moisture from the Gulf of Mexico.

[6] By FRANK E. HOUGHTON, climatologist for New Mexico, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation data*

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Average number of days with precipitation	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	0.10 inch or more	0.25 inch or more
	°F.	°F.	°F.	°F.	In.	In.	In.		
January	52	24	68	9	0.42	0.1	1.0	1	1
February	56	26	72	11	.42	.1	1.3	1	1
March	63	32	78	16	.59	(1)	1.2	1	1
April	72	42	87	29	.88	.1	1.9	2	1
May	80	51	93	40	2.26	.8	5.0	4	3
June	91	61	101	52	1.61	.2	3.4	3	2
July	94	65	102	59	2.75	.9	4.4	5	3
August	92	64	101	57	2.50	.8	4.6	5	3
September	86	56	96	46	1.35	.1	2.4	3	2
October	75	45	87	34	1.12	.2	2.6	2	1
November	62	32	76	19	.49	(1)	1.1	1	1
December	54	25	70	12	.64	(1)	1.6	1	1
Year	73	44	[2] 104	[3] 1	15.03	9.7	19.5	29	20

[1] 0.005 inch, the smallest measurable amount. [2] Average annual highest temperature. [3] Average annual lowest temperature.

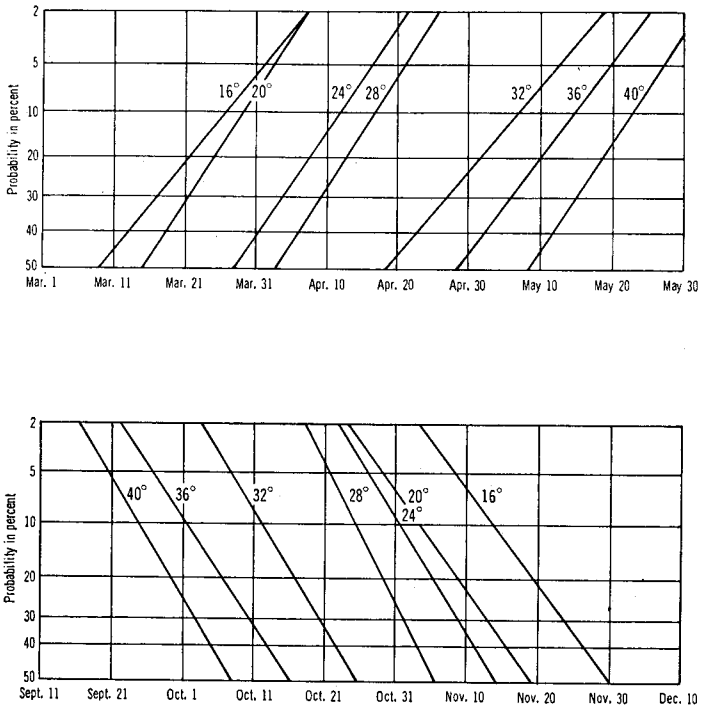

***Figure 20.*—Upper graph: Probability of 16°, 20°, 24°, 28°, 32°, 36°, or 40° temperature in spring after any indicated date. Lower graph: Probability of 16°, 20°, 24°, 28°, 32°, 36°, or 40° temperature in autumn before any indicated date.**

Hail accompanies some of the more severe thunderstorms, but this generally affects only small areas. Prolonged periods of rainfall are rare. The heaviest recorded rainfall was at Porter on October 10 and 11, 1930, when 9.91 inches fell in 24 hours and set a state record. The highest annual total rainfall recorded was 45.51 inches at Obar in 1941. The lowest annual total was 5.32 inches at Nara Visa in 1956. The greatest monthly total was 11.95 inches at Porter in October 1930. All months of the year except July and August have passed with no rainfall at all in one or more parts of the Area.

Average annual snowfall in the Tucumcari Area ranges from about 12 inches in the northeast part to about 18 inches in the central part. The snow falls mostly from November through April but occasionally falls in September, October, and May. It falls on an average of only 1 or 2 days a month, however, and seldom remains on the surface longer than a few days. The heaviest snowfall was about 15 inches in a 24-hour period. High winds sometimes accompany the snow and cause severe drifting and near-blizzard conditions for several hours at a time in places.

Average annual relative humidity in the Area is about 50 percent. It is slightly lower than this amount in spring months and summer months. Daily humidity ranges generally from 64 to 75 percent in the early morning and from 30 to 40 percent in the late afternoon.

Average annual evaporation in the Area, as measured in an evaporation pan, is approximately 95 to 100 inches. Average annual lake evaporation ranges from 62 to 68 inches. Table 10 gives the average monthly pan evaporation for the six-month period April through September, which is when about two-thirds of annual evaporation occurs. Also given in table 10 is the average monthly windspeed just above the evaporation pan (2 feet above ground). Data are based on measurements made by the Northeastern Substation of New Mexico State University for the period 1931 through 1960 (*12*).

Winds are predominantly from the southwest and west. Average annual windspeed is 12 miles per hour.

TABLE 10.—*Average monthly evaporation and windspeed*

Month	Average evaporation	Average windspeed
	Inches	*Miles per hour*
January		4. 7
February		5. 4
March		6. 3
April	8. 75	6. 3
May	10. 41	5. 6
June	12. 50	5. 3
July	12. 19	4. 3
August	10. 61	4. 0
September	8. 75	4. 3
October		4. 0
November		4. 2
December		4. 1

October is the month of lowest average windspeed at 9.5 miles per hour. Windspeeds over 24 miles per hour occur only 5 percent of the time. Dust blows in dry periods, especially when windspeed exceeds 20 miles per hour. Of the total number of yearly duststorms, 60 percent occur in the three-month period February through April, and 25 percent occur in the month of March. Tornadoes are infrequent in the Tucumcari Area. The reported average occurrence is 1 year in 10, and recorded serious damage is small.

An average of 75 percent of the possible sunshine can be expected during the year. Average cloud cover during cloudy days is about four tenths. About 67 percent of the days in the year have no clouds to three-tenths coverage and are officially classified as clear. The rest have eight-tenths or more coverage and are officially classified as cloudy. September has the least cloudiness. Fog is unusual in the Area, and when it does occur it seldom lasts long.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water holding capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Buried soil. A developed soil, once exposed but now overlain by more recently formed soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Decreaser. Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Such production usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Friability. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Increasers. Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasers commonly are shorter than decreasers, and some are less palatable to livestock.

Intergrade, soil. Soils that have moderately well developed distinguishing characteristics of two or more genetically related great soil groups.

Invaders. On range, plants that come in and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface. (Most weeds are "invaders.")

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Loam. Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example,

a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Pediment. A gently inclined erosion surface of low relief, typically developed in arid or semiarid regions at the foot of a receding mountain slope. The pediment may be bare or mantled by a thin layer of alluvium in transit to the adjoining basin.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil series or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Piping, soil. Subsurface erosion that causes the formation of tunnel-like cavities. Piping begins as tiny tunnels or elongated cavities, but these may enlarge to several feet in diameter, some to more than 10 feet. In advanced stages piping appears as a series of tubes or tunnels rather than as channels or gullies. As the pipes enlarge, their roofs collapse locally and the landform becomes karstlike in appearance.

Pore space. That fraction of the total space in a soil that is not occupied by solid particles.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Range seeding. Establishing perennial grasses or improved reseeding grasses or legumes on rangeland to prevent the loss of soil and water and to restore the productivity of native grassland.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climate vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline.	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Only the upper part of this, modified by organisms and other soil-building forces, is regarded by soil scientists as soil. Most American engineers speak of the whole regolith, even to great depths, as "soil."

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slope class name. Word description of slopes provided in addition to the numerical slope range given in the correlated name of a mapping unit. The slope class name provides additional information by indicating whether slopes are single or complex, thus describing shape to some extent. These are the slope class names for this survey area:

Soil slope percentage	*Single slopes*	*Complex slopes*
0–1	Level	Nearly level.
1–3	Nearly level	Gently undulating.
3–5	Gently sloping	Undulating.
5–9	Moderately sloping	Gently rolling.
9–15		Rolling.
15–25		Hilly.
25–50		Steep.
50–80		Very steep.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil is the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or

flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Valley fill. Alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediment onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NEW MEXICO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

TUCUMCARI AREA, NEW MEXICO

Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS *

AREAS DOMINATED BY SOILS OF THE SOUTHERN HIGH PLAINS; MAINLY USED FOR RANGE AND DRYFARMED CROPS

1 — Amarillo-Springer association: Nearly level to gently rolling, deep, sandy and loamy soils on uplands

2 — Bascom-Potter association: Nearly level to gently sloping, deep, loamy soils and gently rolling or strongly sloping, loamy soils that are shallow to cemented caliche; on uplands

3 — Tivoli-Springer-Dune land association: Undulating to hilly, deep, sandy soils on uplands

4 — Amarillo-Ima association: Nearly level to gently sloping or gently undulating, deep, loamy soils on uplands and alluvial fans

AREAS DOMINATED BY ROCKY OR STONY LAND TYPES; MAINLY USED FOR RANGE

5 — Rock land-Rough broken and stony land association: Hilly to very steep, very shallow and shallow, rocky and stony land types

AREAS DOMINATED BY SOILS OF THE PECOS-CANADIAN PLAINS AND VALLEYS; MAINLY USED FOR RANGE AND IRRIGATED CROPS

6 — Quay-Montoya-Lacita association: Nearly level to strongly sloping, deep, loamy soils on alluvial fans, low terraces, and flood plains

7 — Ima-Tucumcari association: Nearly level to gently undulating or gently sloping, deep, loamy soils on alluvial fans

8 — Redona-Canez association: Nearly level to strongly sloping, deep, loamy and sandy soils on alluvial fans, terraces, and valley sides

AREAS DOMINATED BY SOILS OF THE PECOS-CANADIAN PLAINS AND VALLEYS; MAINLY USED FOR RANGE

9 — Lacita-La Lande-Quay association: Nearly level to strongly sloping, deep, loamy soils on alluvial fans

10 — Latom-Rock outcrop association: Sloping to steep, shallow and very shallow, stony soils and rock outcrop on upland ridges

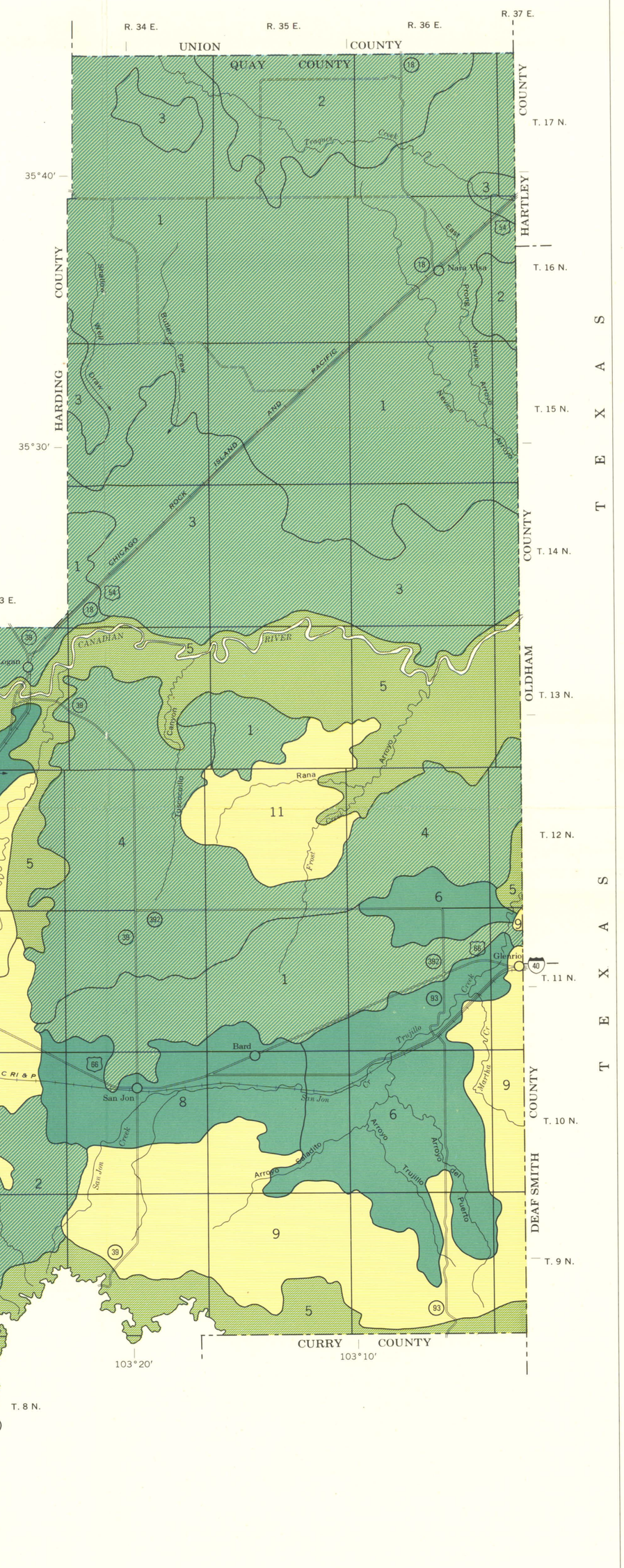
11 — San Jon-Los Tanos-Ima association: Gently sloping, moderately deep and deep, loamy soils on pediments, ridges, and alluvial fans

12 — Gallegos association: Gently undulating to hilly, deep, gravelly soils on old terraces

* Texture named in soil associations is that of the surface layer.

Compiled 1972

N



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

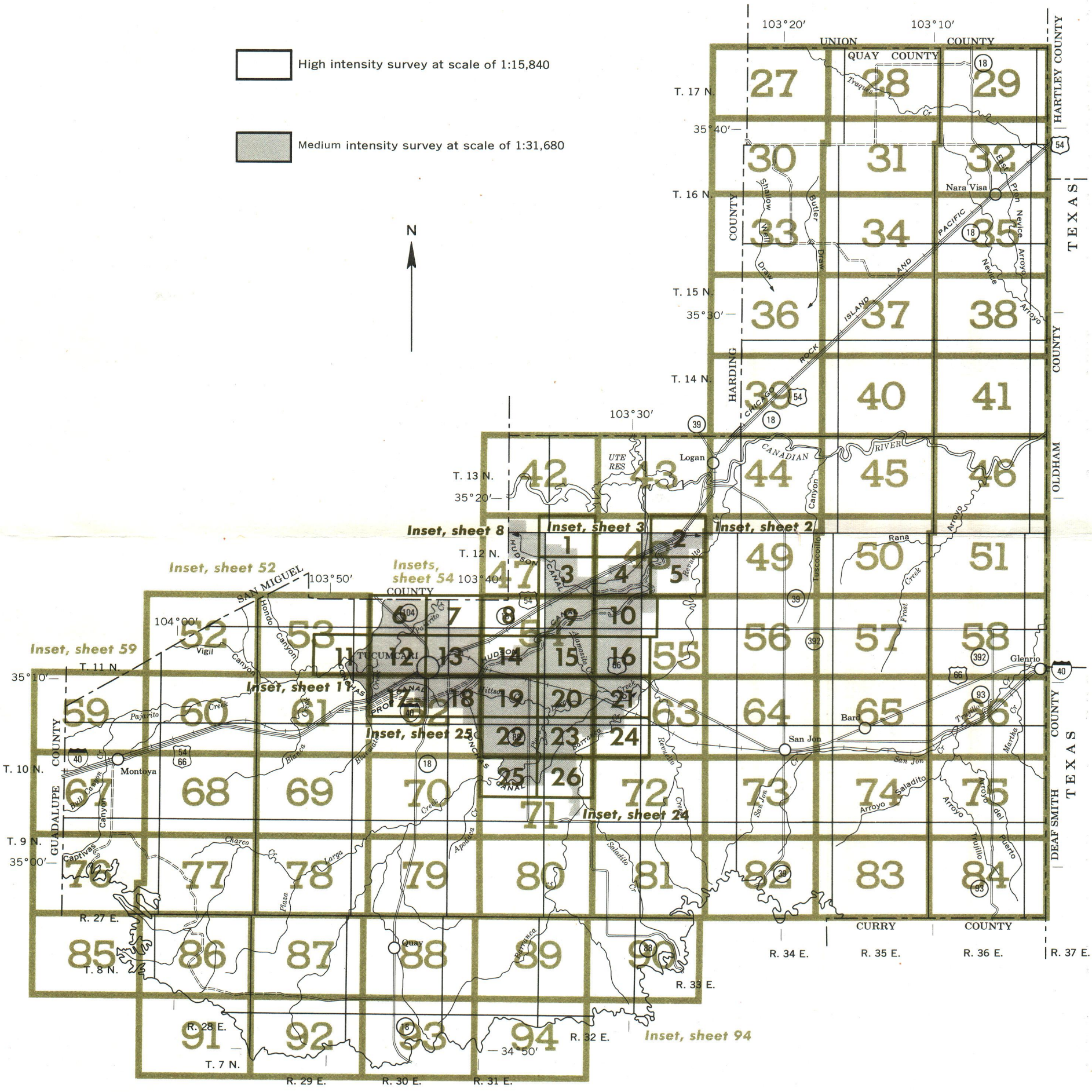
TUCUMCARI AREA, NEW MEXICO

Scale 1:443,520

1 0 1 2 3 4 5 6 7 Miles

High intensity survey at scale of 1:15,840

Medium intensity survey at scale of 1:31,680



SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the medium intensity survey; it is a small letter if the mapping unit is one of the high intensity survey.

SYMBOL		NAME
High Intensity	Medium Intensity	
-	AL	Amarillo loamy fine sand, 0 to 3 percent slopes
-	AM	Amarillo loamy fine sand, eroded
-	AR	Amarillo fine sandy loam, 0 to 3 percent slopes
-	BA	Bascom fine sandy loam, 0 to 3 percent slopes
-	BB	Bascom fine sandy loam, 3 to 9 percent slopes
-	BC	Bascom loam, 0 to 3 percent slopes
-	BD	Bascom loam, 3 to 9 percent slopes
-	BE	Bascom complex
-	BF	Bascom-Potter fine sandy loams, 1 to 9 percent slopes
-	BG	Bascom-Potter loams, 1 to 9 percent slopes
Bh	-	Bascom-Potter complex, 1 to 9 percent slopes
-	BK	Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes
-	BM	Bascom loam, nongravelly variant, 0 to 3 percent slopes
-	BN	Brownfield fine sand, 0 to 3 percent slopes
-	BO	Brownfield fine sand, eroded
Ca	-	Canez loamy fine sand, 0 to 3 percent slopes
-	CB	Canez loamy fine sand, 1 to 5 percent slopes
Cc	-	Canez loamy fine sand, 3 to 9 percent slopes
Cd	-	Canez loamy fine sand, 0 to 3 percent slopes, hummocky
Ce	-	Canez fine sandy loam, 0 to 3 percent slopes
-	CF	Canez fine sandy loam, 1 to 5 percent slopes
Ch	CI	Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes
Cn	-	Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes
-	CV	Canez loam, calcareous variant, 0 to 3 percent slopes
-	DU	Dune land
-	GA	Gallegos very gravelly loam, 1 to 9 percent slopes
Gg	GH	Gallegos very gravelly loam, 9 to 25 percent slopes
Gl	-	Gallegos complex, 3 to 9 percent slopes
Gm	GN	Gomez loamy fine sand, 0 to 3 percent slopes
-	GU	Gullied land, San Jon material
Im	-	Ima sandy loam, 1 to 3 percent slopes
-	IN	Ima sandy loam, 1 to 5 percent slopes
Is	-	Ima sandy loam, 3 to 5 percent slopes
-	KL	Kinkead clay loam, 0 to 3 percent slopes
Km	-	Kinkead clay loam, 0 to 1 percent slopes
Kn	-	Kinkead clay loam, 1 to 3 percent slopes
La	-	Lacita silt loam, 0 to 1 percent slopes
-	LC	Lacita silt loam, 0 to 3 percent slopes
Ld	-	Lacita silt loam, 1 to 3 percent slopes
-	LE	Lacita silt loam and Gullied land
-	-	Lakes
Ll	-	La Lande fine sandy loam, 0 to 1 percent slopes
Lm	-	La Lande fine sandy loam, 1 to 3 percent slopes
-	LN	La Lande fine sandy loam, 1 to 5 percent slopes
Lo	-	La Lande loam, 0 to 1 percent slopes
Lp	-	La Lande loam, 1 to 3 percent slopes
-	LR	La Lande loam, 0 to 5 percent slopes
Ls	-	La Lande loam, 3 to 5 percent slopes
Lt	-	Latom stony loam, 3 to 9 percent slopes
-	LU	Latom stony sandy loam, 3 to 9 percent slopes
-	LV	Latom-Rock outcrop complex, hilly
-	LW	Latom-Rock outcrop complex, steep
Lx	LY	Los Tanos sandy loam, 1 to 5 percent slopes
Mn	MO	Minneosa loamy fine sand
-	MP	Montoya clay loam
Mr	-	Montoya clay loam, 0 to 1 percent slopes
Ms	-	Montoya clay loam, 1 to 3 percent slopes
-	MT	Montoya clay loam and Gullied land
-	OT	Olton loam, 0 to 3 percent slopes
Po	PT	Potter loam, 1 to 9 percent slopes
Qd	-	Quay fine sandy loam, 0 to 1 percent slopes
Qe	-	Quay fine sandy loam, 1 to 3 percent slopes
Qf	-	Quay loam, 0 to 1 percent slopes
Qg	-	Quay loam, 1 to 3 percent slopes
-	QH	Quay loam, 0 to 5 percent slopes
Qk	-	Quay loam, 3 to 9 percent slopes
Ql	-	Quay loam, sandstone substratum, 0 to 1 percent slopes
Qm	-	Quay loam, sandstone substratum, 1 to 3 percent slopes
Qn	-	Quay loam, shale substratum, 1 to 3 percent slopes
-	QO	Quay loam, shale substratum, 1 to 5 percent slopes
Rd	RE	Redona loamy fine sand, 0 to 3 percent slopes
-	RF	Redona loamy fine sand, 0 to 3 percent slopes, eroded
Rg	-	Redona loamy fine sand, 3 to 5 percent slopes
Rh	-	Redona loamy fine sand, 0 to 3 percent slopes, hummocky
Rk	-	Redona fine sandy loam, 0 to 1 percent slopes
-	RM	Redona fine sandy loam, 0 to 3 percent slopes
Rn	-	Redona fine sandy loam, 1 to 3 percent slopes
Ro	-	Redona loam, 0 to 1 percent slopes
Rp	-	Redona loam, 1 to 3 percent slopes
Rr	RS	Riverwash
Rt	RU	Rock land
Rv	RW	Rough broken and stony land, hilly
Rx	RY	Rough broken and stony land, steep
Sa	SB	San Jon loam, 1 to 5 percent slopes
Sc	-	San Jose loam, 0 to 1 percent slopes
-	SD	San Jose loam, 0 to 3 percent slopes
-	SE	Sharvana sandy loam, 0 to 3 percent slopes
-	SF	Springer-Amarillo association
-	SG	Springer loamy fine sand, 0 to 3 percent slopes
-	SH	Springer loamy fine sand, 0 to 3 percent slopes, eroded
-	SK	Springer loamy fine sand, 3 to 9 percent slopes
-	SM	Springer fine sandy loam, 0 to 3 percent slopes
-	SN	Springer fine sandy loam, 3 to 9 percent slopes
-	TF	Tivoli fine sand
Th	TK	Toyah loam, 0 to 3 percent slopes
Tm	-	Tucumcari clay loam, 0 to 1 percent slopes
-	TN	Tucumcari clay loam, 0 to 3 percent slopes
To	-	Tucumcari clay loam, 1 to 3 percent slopes

TUCUMCARI AREA, NEW MEXICO

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Limit of soil survey
- Soil intensity
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
- Unclassified

Aqueduct tunnel

Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

Spring

Well, irrigation

Wet spot

Drainage end or alluvial fan

Siphon

RELIEF

Escarpments

- Bedrock
- Other

Short steep slope

Prominent peak

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Overblown Soil

Soil Sample Site (S)

Wind hummock

Borrow pit (B.P.)

Caliche pit (C.P.)

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability subclass or unit, range site, or wildlife habitat group, read the introduction to the section it is in as well, for general information about its management. For information about woodland and windbreaks, refer to the section beginning on page 58. Absence of data in a column indicates that the unit was mapped at the other intensity or that it was not placed in an interpretive group of that particular type. Other information is given in tables as follows:

Acreage and extent, table 1, page 10.
Estimated yields, table 2, page 51.
Wildlife habitat group suitability, table 3, page 61.

Engineering uses of the soils, tables 4, 5, and 6, pages 64 through 78.
Community development and recreation, table 7, page 80.

H I G H I N T E N S I T Y

Map symbol	Mapping unit	Page	Capability subclass or unit: Irrigated Symbol	Irrigated Page	Dryland Symbol	Dryland Page	Range site: Name	Range site Page	Wildlife habitat group Symbol
Bh	Bascom-Potter complex, 1 to 9 percent slopes	14	-----	--	VIe	50	----	--	C
	Bascom	--	-----	--	----	--	Sandy	57	--
	Potter	--	-----	--	----	--	Shallow	57	--
Ca	Canez loamy fine sand, 0 to 3 percent slopes	17	IVe-8	47	VIe	50	Deep Sand	54	B
Cc	Canez loamy fine sand, 3 to 9 percent slopes	17	IVe-13	47	VIe	50	Deep Sand	54	B
Cd	Canez loamy fine sand, 0 to 3 percent slopes, hummocky	17	-----	--	VIIe	50	Deep Sand	54	B
Ce	Canez fine sandy loam, 0 to 3 percent slopes	17	IIIe-4	45	VIe	50	Sandy	57	A
Ch	Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes	18	IIIe-4	45	VIe	50	Sandy	57	A
Cn	Canez fine sandy loam, calcareous variant, 3 to 9 percent slopes	18	IVe-13	47	VIe	50	Sandy	57	A
Gg	Gallegos very gravelly loam, 9 to 25 percent slopes	19	-----	--	VIe	50	Shallow	57	C
Gl	Gallegos complex, 3 to 9 percent slopes	20	-----	--	VIe	50	Shallow	57	C
Gm	Gomez loamy fine sand, 0 to 3 percent slopes	20	IVe-8	47	VIe	50	Deep Sand	54	B
Im	Ima sandy loam, 1 to 3 percent slopes	21	IIIe-4	45	VIe	50	Sandy	57	B
Is	Ima sandy loam, 3 to 5 percent slopes	21	IVe-13	47	VIe	50	Sandy	57	B
Km	Kinkead clay loam, 0 to 1 percent slopes	22	IIs-1	45	VIe	50	Loamy	55	D
Kn	Kinkead clay loam, 1 to 3 percent slopes	22	IIIe-12	46	VIe	50	Loamy	55	D
La	Lacita silt loam, 0 to 1 percent slopes	23	IIe-7	45	VIe	50	Loamy	55	D
Ld	Lacita silt loam, 1 to 3 percent slopes	23	IIIe-12	46	VIe	50	Loamy	55	D
Ll	La Lande fine sandy loam, 0 to 1 percent slopes	25	IIe-3	45	VIe	50	Sandy	57	A
Lm	La Lande fine sandy loam, 1 to 3 percent slopes	25	IIIe-4	45	VIe	50	Sandy	57	A
Lo	La Lande loam, 0 to 1 percent slopes	25	IIe-1	44	VIe	50	Loamy	55	A
Lp	La Lande loam, 1 to 3 percent slopes	25	IIe-8	45	VIe	50	Loamy	55	A
Ls	La Lande loam, 3 to 5 percent slopes	25	IVe-13	47	VIe	50	Loamy	55	A
Lt	Latom stony loam, 3 to 9 percent slopes	26	-----	--	VIIs	50	Shallow Sandstone	58	C
Lx	Los Tanos sandy loam, 1 to 5 percent slopes	27	IVe-1	47	VIe	50	Sandy	57	B
Mn	Minneosa loamy fine sand	28	-----	--	VIIe	50	Deep Sand	54	B
Mr	Montoya clay loam, 0 to 1 percent slopes	29	IVs-3	47	VIew	50	Salt Flats	56	D
Ms	Montoya clay loam, 1 to 3 percent slopes	29	IVs-3	47	VIew	50	Salt Flats	56	D
Po	Potter loam, 1 to 9 percent slopes	31	-----	--	VIIs	50	Shallow	57	C
Qd	Quay fine sandy loam, 0 to 1 percent slopes	32	IIe-3	44	VIe	50	Sandy	57	A
Qe	Quay fine sandy loam, 1 to 3 percent slopes	32	IIIe-4	45	VIe	50	Sandy	57	A
Qf	Quay loam, 0 to 1 percent slopes	32	IIe-1	44	VIe	50	Loamy	55	A
Qg	Quay loam, 1 to 3 percent slopes	32	IIIe-6	46	VIe	50	Loamy	55	A
Qk	Quay loam, 3 to 9 percent slopes	32	IVe-13	47	VIe	50	Loamy	55	A
Ql	Quay loam, sandstone substratum, 0 to 1 percent slopes	32	IIIe-6	46	VIe	50	Loamy	55	A
Qm	Quay loam, sandstone substratum, 1 to 3 percent slopes	32	IIIe-6	46	VIe	50	Loamy	55	A
Qn	Quay loam, shale substratum, 1 to 3 percent slopes	33	IVe-1	47	VIe	50	Loamy	55	A
Rd	Redona loamy fine sand, 0 to 3 percent slopes	34	IIIe-10	46	VIe	50	Deep Sand	54	B
Rg	Redona loamy fine sand, 3 to 5 percent slopes	34	IVe-13	47	VIe	50	Deep Sand	54	B
Rh	Redona loamy fine sand, 0 to 3 percent slopes, hummocky	34	IVe-8	47	VIe	50	Deep Sand	54	B
Rk	Redona fine sandy loam, 0 to 1 percent slopes	34	IIe-3	44	VIe	50	Sandy	57	A
Rn	Redona fine sandy loam, 1 to 3 percent slopes	35	IIIe-4	45	VIe	50	Sandy	57	A
Ro	Redona loam, 0 to 1 percent slopes	35	IIe-1	44	VIe	50	Loamy	55	A
Rp	Redona loam, 1 to 3 percent slopes	35	IIe-8	45	VIe	50	Loamy	55	A
Rr	Riverwash	35	-----	--	VIIIw	51	-----	--	F
Rt	Rock land	35	-----	--	VIIs	50	Breaks	54	E
Rv	Rough broken and stony land, hilly	36	-----	--	VIIe	50	Hills	55	E
Rx	Rough broken and stony land, steep	36	-----	--	VIIe	50	Breaks	54	E
Sa	San Jon loam, 1 to 5 percent slopes	38	-----	--	VIe	50	Clayey	54	C
Sc	San Jose loam, 0 to 1 percent slopes	38	IIe-1	44	VIe	50	Loamy	55	A
Th	Toyah loam, 0 to 3 percent slopes	41	IIe-8	45	IIIec	49	Loamy	55	A
Tm	Tucumcari clay loam, 0 to 1 percent slopes	42	IIe-7	45	VIe	50	Clayey	54	D
To	Tucumcari clay loam, 1 to 3 percent slopes	42	IIIe-12	46	VIe	50	Clayey	54	D

M E D I U M I N T E N S I T Y

Map symbol	Mapping unit	Page	Dryland capability subclass or unit: Symbol	Dryland capability subclass or unit: Page	Range site: Name	Range site: Page	Wildlife habitat group: Symbol
AL	Amarillo loamy fine sand, 0 to 3 percent slopes	11	IVe-4	49	Deep Sand	54	B
AM	Amarillo loamy fine sand, eroded	11	VIe	50	Deep Sand	54	B
AR	Amarillo fine sandy loam, 0 to 3 percent slopes	12	IIIe-1	49	Sandy	57	A
BA	Bascom fine sandy loam, 0 to 3 percent slopes	13	VIe	50	Sandy	57	C
BB	Bascom fine sandy loam, 3 to 9 percent slopes	13	VIe	50	Sandy	57	C
BC	Bascom loam, 0 to 3 percent slopes	13	VIe	50	Sandy	57	C
BD	Bascom loam, 3 to 9 percent slopes	13	VIe	50	Sandy	57	C
BE	Bascom complex	13	VIe	50	Sandy	57	C
BF	Bascom-Potter fine sandy loams, 1 to 9 percent slopes	13	VIe	50	-----	--	C
	Bascom	--	----	--	Sandy	57	--
	Potter	--	----	--	Shallow	57	--
BG	Bascom-Potter loams, 1 to 9 percent slopes	14	VIe	50	-----	--	C
	Bascom	--	----	--	Sandy	57	--
	Potter	--	----	--	Shallow	57	--
BK	Bascom fine sandy loam, nongravelly variant, 0 to 3 percent slopes	15	IIIe-1	49	Sandy	57	A
BM	Bascom loam, nongravelly variant, 0 to 3 percent slopes	15	IIIec-1	49	Loamy	55	A
BN	Brownfield fine sand, 0 to 3 percent slopes	15	VIe	50	Deep Sand	54	B
BO	Brownfield fine sand, eroded	15	VIIe	50	Deep Sand	54	B
CB	Canez loamy fine sand, 1 to 5 percent slopes	17	VIe	50	Deep Sand	54	B
CF	Canez fine sandy loam, 1 to 5 percent slopes	17	VIe	50	Sandy	57	A
CL	Canez fine sandy loam, calcareous variant, 0 to 3 percent slopes	18	VIe	50	Sandy	57	A
CV	Canez loam, calcareous variant, 0 to 3 percent slopes	18	VIe	50	Sandy	57	A
DU	Dune land	18	VIIIe	51	-----	--	F
GA	Gallegos very gravelly loam, 1 to 9 percent slopes	19	VIe	50	Shallow	57	C
GH	Gallegos very gravelly loam, 9 to 25 percent slopes	19	VIe	50	Shallow	57	C
GN	Gomez loamy fine sand, 0 to 3 percent slopes	20	VIe	50	Deep Sand	54	B
GU	Gullied land, San Jon material	20	VIIIe	51	-----	--	F
IN	Ima sandy loam, 1 to 5 percent slopes	21	VIe	50	Sandy	57	B
KL	Kinkead clay loam, 0 to 3 percent slopes	22	VIe	50	Loamy	55	D
LC	Lacita silt loam, 0 to 3 percent slopes	23	VIe	50	Loamy	55	D
LE	Lacita silt loam and Gullied land	23	----	--	-----	--	--
	Lacita	--	VIe	50	Loamy	55	D
	Gullied land	--	VIIIe	51	-----	--	F
LN	La Lande fine sandy loam, 1 to 5 percent slopes	25	VIe	50	Sandy	57	A
LR	La Lande loam, 0 to 5 percent slopes	25	VIe	50	Loamy	55	A
LU	Latom stony sandy loam, 3 to 9 percent slopes	26	VIIs	50	Shallow Sandstone	58	C
LV	Latom-Rock outcrop complex, hilly	26	VIIs	50	Shallow Sandstone	58	E
LW	Latom-Rock outcrop complex, steep	26	VIIs	50	Breaks	54	E
LY	Los Tanos sandy loam, 1 to 5 percent slopes	27	VIe	50	Sandy	57	B
MO	Minneosa loamy fine sand	28	VIIe	50	Deep Sand	54	B
MP	Montoya clay loam	29	VIew	50	Salt Flats	56	D
MT	Montoya clay loam and Gullied land	29	----	--	-----	--	--
	Montoya	--	VIew	50	Salt Flats	56	D
	Gullied land	--	VIIIe	--	-----	--	F
OT	Olton loam, 0 to 3 percent slopes	30	IIIec-1	49	Loamy	55	A
PT	Potter loam, 1 to 9 percent slopes	31	VIIs	50	Shallow	57	C
QH	Quay loam, 0 to 5 percent slopes	32	VIe	50	Loamy	55	A
QO	Quay loam, shale substratum, 1 to 5 percent slopes	33	VIe	50	Loamy	55	A
RE	Redona loamy fine sand, 0 to 3 percent slopes	34	VIe	50	Deep Sand	54	B
RF	Redona loamy fine sand, 0 to 3 percent slopes, eroded	34	VIe	50	Deep Sand	54	B
RM	Redona fine sandy loam, 0 to 3 percent slopes	34	VIe	50	Sandy	57	A
RS	Riverwash	35	VIIIw	51	-----	--	F
RU	Rock land	35	VIIs	50	Breaks	54	E
RW	Rough broken and stony land, hilly	36	VIIe	50	Hills	55	E
RY	Rough broken and stony land, steep	36	VIIe	50	Breaks	54	E
SB	San Jon loam, 1 to 5 percent slopes	38	VIe	50	Clayey	54	C
SD	San Jose loam, 0 to 3 percent slopes	38	VIe	50	Loamy	55	A
SE	Sharvana sandy loam, 0 to 3 percent slopes	39	VIe	50	Sandy	57	C
SF	Springer-Amarillo association	39	----	--	Deep Sand	54	--
	Springer	--	VIe	50	-----	--	B
	Amarillo	--	IVe-4	49	-----	--	B
SG	Springer loamy fine sand, 0 to 3 percent slopes	40	VIe	50	Deep Sand	54	B
SH	Springer loamy fine sand, 0 to 3 percent slopes, eroded	40	VIIe	50	Sand Hills	56	B
SK	Springer loamy fine sand, 3 to 9 percent slopes	40	VIe	50	Deep Sand	54	B
SM	Springer fine sandy loam, 0 to 3 percent slopes	40	IVe-5	49	Deep Sand	54	A
SN	Springer fine sandy loam, 3 to 9 percent slopes	40	VIe	50	Deep Sand	54	A
TF	Tivoli fine sand	41	VIIe	50	Sand Hills	56	B
TK	Toyah loam, 0 to 3 percent slopes	42	IIIec-1	49	Loamy	55	A
TN	Tucumcari clay loam, 0 to 3 percent slopes	42	VIe	50	Clayey	54	D

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 1

720 000 FEET

1 570 000 FEET

T. 12 N.

(Joins inset, sheet 8)

(Joins sheet 47-1:31 680)

(Joins sheet 3)

R. 31 E. | R. 32 E

735 000 FEET

(Joins sheet 48-1:31 680)

752 000 FEET

R. 33 E.

1 565 000 FEET

(Joins sheet 2)

(Joins sheet 4)

754 000 FEET

1 560 000 FEET

CHICAGO ROCK ISLAND AND PACIFIC

2 000 AND 5 000-FOOT GRID TICKS

1 Mile

5 000 Feet

Scale 1:15840

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

(2)

N

1 Mile
5 000 Feet

Scale 1:15840

770 000 FEET

1 570 000 FEET

(Joins sheet 48-1:31 680) | (Joins sheet 49-1:31 680)

R. 33 E.

775 000 FEET

1 566 000 FEET

(Joins lower right)

1 565 000 FEET

T. 12 N.

(Joins sheet 49-1:31 680)

774 000 FEET

(Joins sheet 49-1:31 680)

1 000-FOOT GRID TICKS

(Joins sheet 48-1:31 680)

(Joins inset sheet 1)

(Joins inset above)

(Joins sheet 48-1:31 680)

T. 12 N.

1 550 000 FEET

755 000 FEET

(Joins sheet 5)

R. 33 E.

ROCK ISLAND AND PACIFIC

CHICAGO

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

N

1 Mile

5000 Feet

0 0

Scale 1:15840

¼ 1000

½ 2000

¾ 3000

1 4000

1½ 5000

750 000 FEET

R. 32 E.

R. 33 E.

(Joins inset, sheet 1)

1 555 000 FEET

T. 12 N.

1 550 000 FEET

740 000 FEET

(Joins sheet 48-1:31 680)

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 10)

CHICAGO ROCK ISLAND AND PACIFIC

HUDSON CANAL

Hudson Lake

intermittent

7 18 14 13 15 22 23 24 19

Bh Ca Cc Cd Ch Cn Gm Lm Lx Qd Qe Rd Rg Rh Rk Rn

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 5

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

R. 33 E.

755 000 FEET

1 555 000 FEET

T. 12 N.

(Joins sheet 4)

(Joins sheet 2)

(Joins sheet 48-1:31 680)

(Joins sheet 10)

(Joins sheet 55-1:31 680)

770 000 FEET

1 550 000 FEET

5

N

1 Mile

5000 Feet

Scale 1:15840

6

N

1 Mile

5000 Feet

Scale 1:15840

680 000 FEET

1 540 000 FEET

1 535 000 FEET

665 000 FEET

SAN MIGUEL COUNTY
QUAY COUNTY

CONCHAS CANAL

BELL LATERAL

CONCHAS SIPHON

Pajarito Creek

(Joins inset 8, sheet 54-1:31 680)

(Joins sheet 12)

(Joins sheet 7)

T. 11 N. | T. 12 N.

R. 30 E.

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 7

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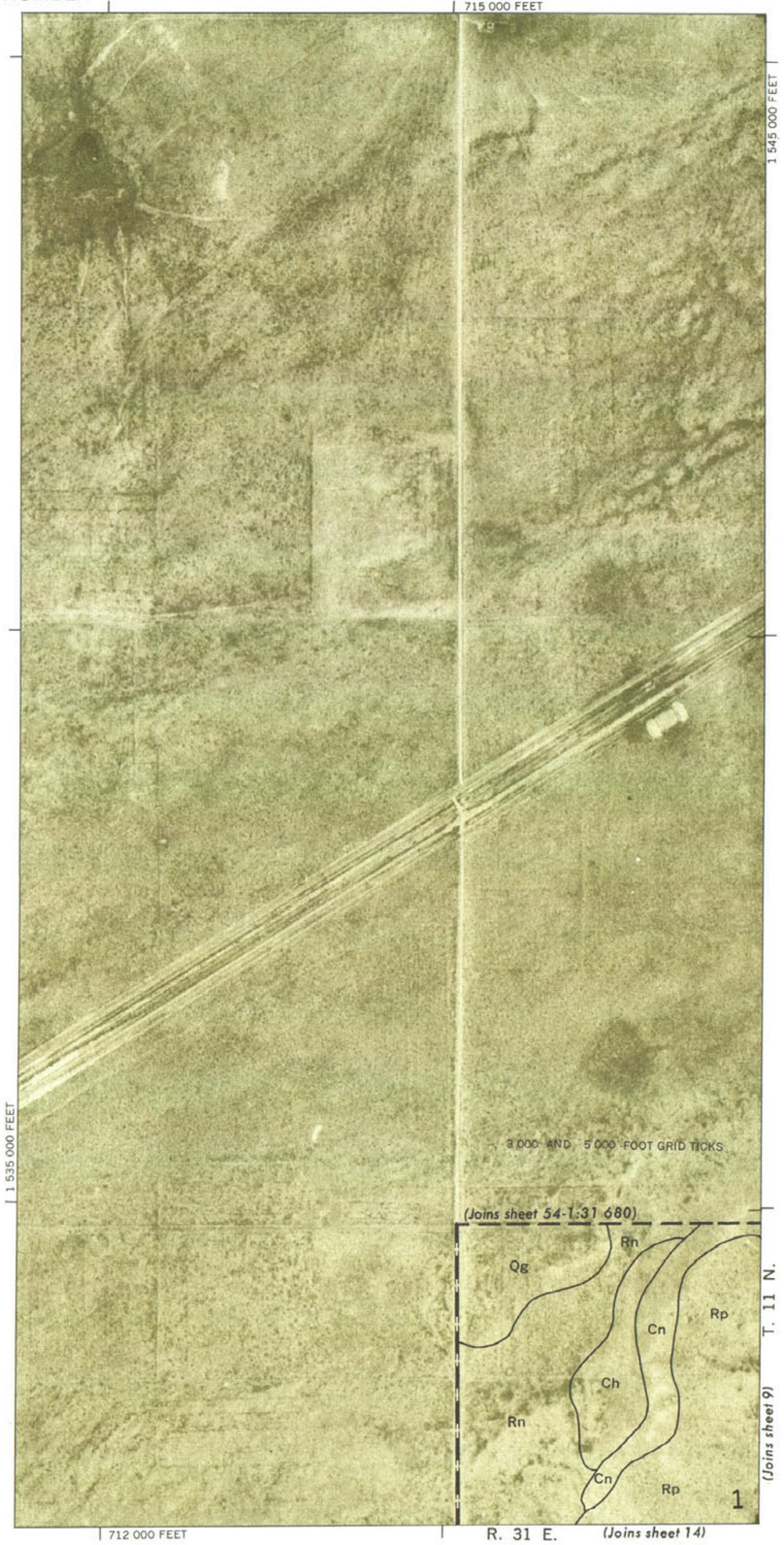
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



8

N

1 Mile

5000 Feet

Scale 1:15840

1 0 0 1/4 1000 1/2 2000 3/4 3000 4000 5000

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 10

10

N

1 Mile

5000 Feet

Scale 1:15840

0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

(Joins sheet 4) | (Joins sheet 5)

R. 32 E. | R. 33 E.

755 000 FEET

1 545 000 FEET

(Joins sheet 9)

(Joins sheet 55-1:31 680)

(Joins sheet 55-1:31 680)

T. 11 N. | T. 12 N.

1 535 000 FEET

740 000 FEET

(Joins sheet 16)

HUDSON CANAL

LATERAL

LATERAL

LATERAL

LATERAL

27 26 25 30 34 35 36 3 2 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

645 000 FEET

1 530 000 FEET

R. 29 E. | R. 30 E.

656 000 FEET

(Joins lower right)

1 515 000 FEET

T. 11 N.

(Joins sheet 17)

660 000 FEET

1 510 000 FEET

4 000 AND 5 000-FOOT GRID TICKS

(Joins sheet 13)

CONCHAS CANAL

TUNNEL

Palomino Creek

(Joins sheet 12)

1 520 000 FEET

R. 29 E. | R. 30 E.

(Joins inset left)

660 000 FEET

11

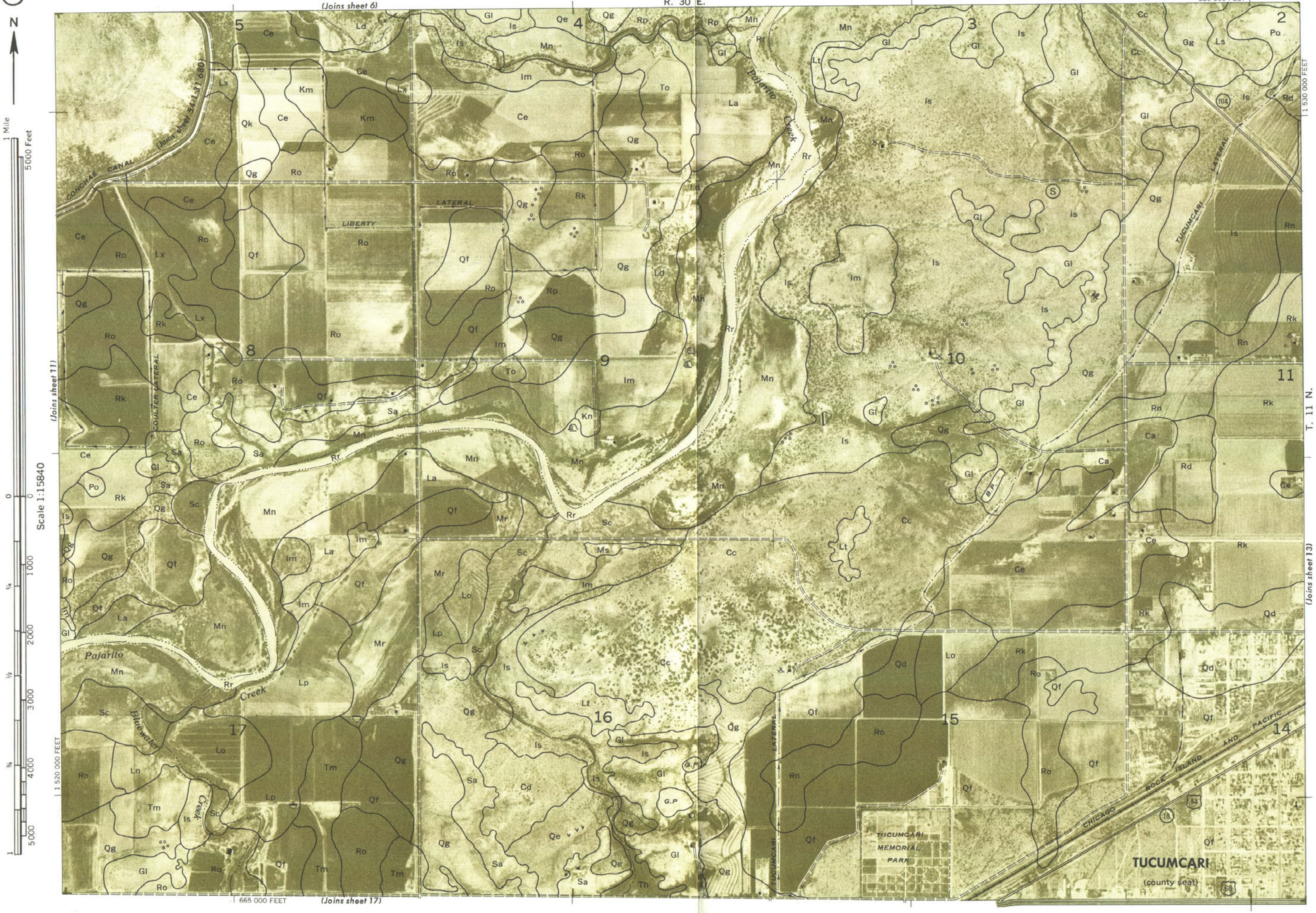
N

1 Mile

5000 Feet

Scale 1:15840

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 12

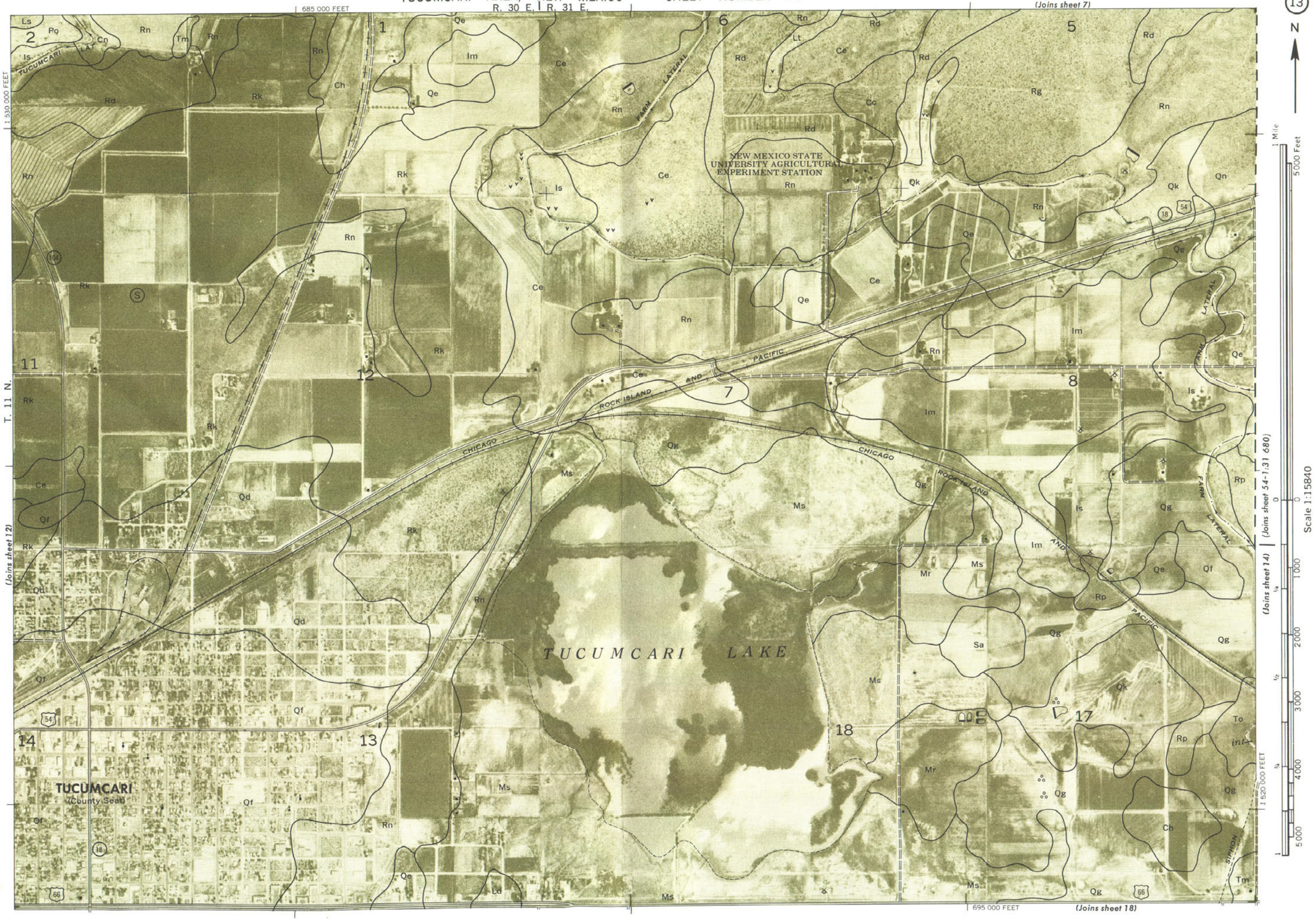


Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 13



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 14

(14)

N

1 Mile

5000 Feet

Scale 1:15840

715 000 FEET

(Joins sheet 8)

1 530 000 FEET

(Joins sheet 54-1:31 680)

(Joins sheet 54-1:31 680)

(Joins sheet 13)

(Joins sheet 15)

1 520 000 FEET

700 000 FEET

(Joins sheet 19)

T. 11 N.

R. 31 E.

HUDSON CANAL

CHICAGO ROCK ISLAND AND PACIFIC

FARM LAT.

SIPHON

BENSON LATERAL

CALICHE PIT

TUCUMCARI MUNICIPAL AIRPORT

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 15

R. 31 E. | R. 32 E.

720 000 FEET

(Joins sheet 9)

15

N

T. 11 N.

1 530 000 FEET

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 20)

1 520 000 FEET

735 000 FEET

TUCUMCARI MUNICIPAL AIRPORT

HUDSON CANAL

FELK LATERAL

BUGG LATERAL

Alamosito Creek

Scale 1:15840

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 16

(16)

N

1 Mile

5 000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 10)

(Joins sheet 15)

(Joins sheet 21)

750 000 FEET

1 530 000 FEET

1 520 000 FEET

740 000 FEET

R. 32 E.

T. 11 N.

(Joins sheet 55-1.3T 680)

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 17

17

N

1 Mile

5000 Feet

Scale 1:15840

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 18

(18)

N

R. 30 E. | R. 31 E.

695 000 FEET

(Joins sheet 13)

Granger School

TUCUMCARI (county seat)

Mountain View School

Hospital

TUNNEL

CONCHAS CANAL

PROPOSED INTERSTATE HWY 40

HUDSON CANAL

SIPHON

T. 11 N.

1 515 000 FEET

(Joins sheet 19)

(Joins sheet 17)

1 510 000 FEET

(Joins sheet 62-1:31 680)

685 000 FEET

(Joins inset, sheet 25)

Scale 1:15840

1 Mile

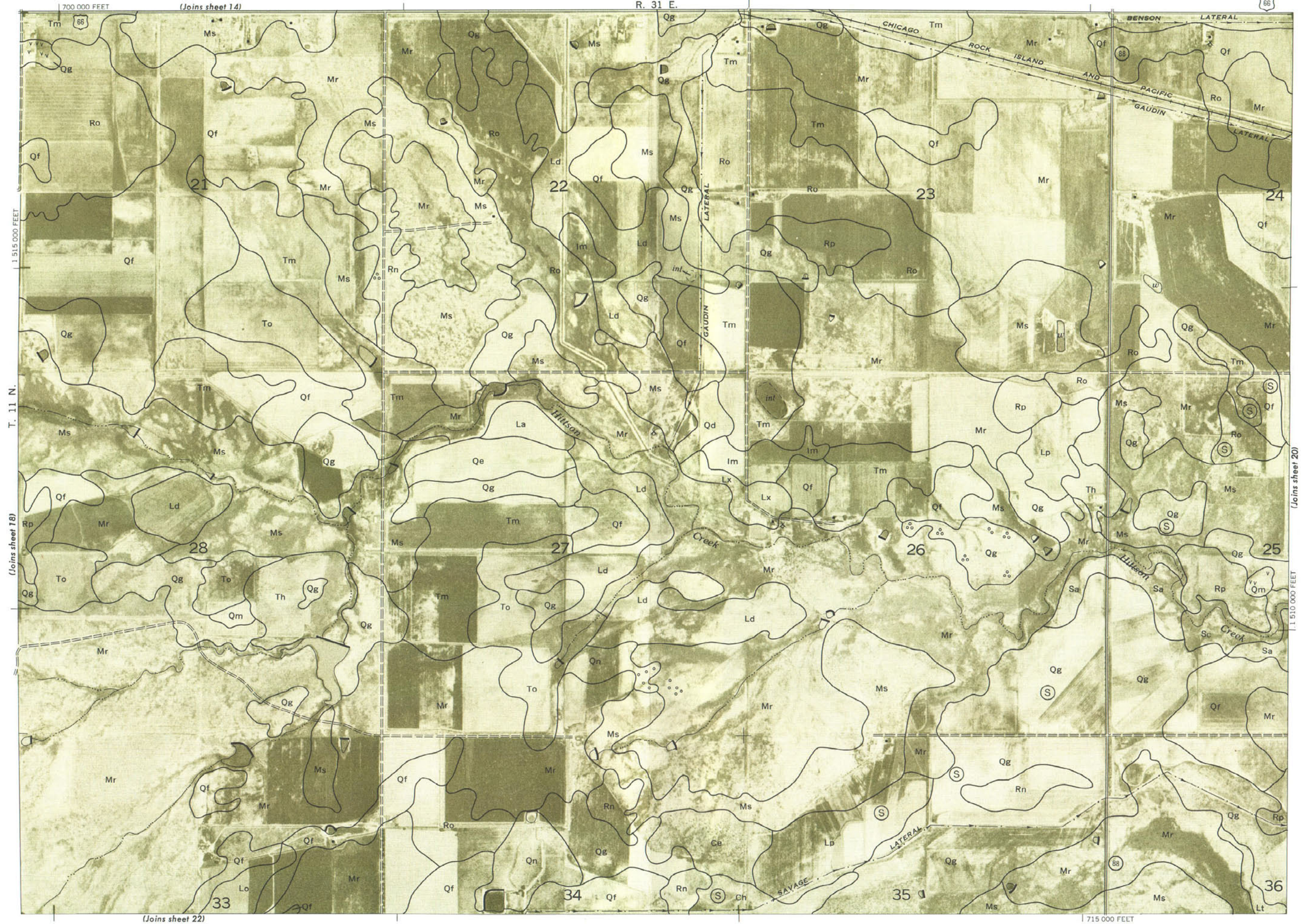
5000 Feet

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 19



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 20

20

N

1 Mile

5000 Feet

R. 31 E. | R. 32 E.

(Joins sheet 15)

735 000 FEET

1 515 000 FEET

T. 11 N.

1 510 000 FEET

720 000 FEET

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 23)

Scale 1:15840

0 0 1000 2000 3000 4000 5000

1/4 1/2 3/4 1

24 19 20 21 25 30 29 28 36 31 32 33

GAUDIN LATERAL

BENSON LATERAL

FELK LATERAL

CHICAGO ROCK ISLAND AND PACIFIC

SIMMONS LATERAL

SAVAGE LATERAL

CONCHAS LATERAL

Hittson Creek

Plaza Larga

Lesbia

intermittent

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 21

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

21

N

1 Mile

5000 Feet

Scale 1:15840

740 000 FEET

755 000 FEET

1 515 000 FEET

1 510 000 FEET

R. 32 E.

T. 11 N.

(Joins sheet 16)

(Joins sheet 20)

(Joins sheet 24)

(Joins sheet 63-1:31 680)

(Joins sheet 63-1:31 680)

BUGG LATERAL

CHICAGO ROCK ISLAND AND PACIFIC

Alamosito Creek

Larga Creek

Plaza Larga Creek

Barranca Creek

Barranca Creek

22 23 24 25 26 27 34 35

22

N

1 Mile

5 000 Feet

Scale 1:15840

(Joins sheet 19)

(Joins sheet 25)

(Joins inset, sheet 25)

(Joins sheet 62-1:31 680)

(Joins sheet 23)

(Joins sheet 25)

R. 31 E.

715 000 FEET

1 505 000 FEET

1 495 000 FEET

700 000 FEET

T. 10 N. | T. 11 N.

33 34 35 36

4 3 2 1

9 10 11 12

SAVAGE LATERAL

CALLISON LATERAL

NEWHOUSE CEMETERY

WHARTON LATERAL

CONCHAS CANAL

intermittent

int

88

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map was compiled in 1972 as part of soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 23

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1959 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 21)

R. 32 E.

T. 11 N.

T. 10 N.

(Joins sheet 23)

(Joins sheet 63-1:31 680)

(Joins sheet 26-1:15 840)

(Joins sheet 71-1:31 680)

LATERAL

THOMAS

Barranca Creek

Lt Creek

34 35 3 2 29 28 32 33

Rk Rn Rd Im Is La Gl Qe Lm Ld Mn Rr Sa Rp Lp Ro Lo Qg Ca Sc Cd Lt Mt

755 000 FEET

1 505 000 FEET

1 495 000 FEET

740 000 FEET

733 000 FEET

1 478 000 FEET

1 475 000 FEET

730 000 FEET

3 000-FOOT GRID TICKS

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 25

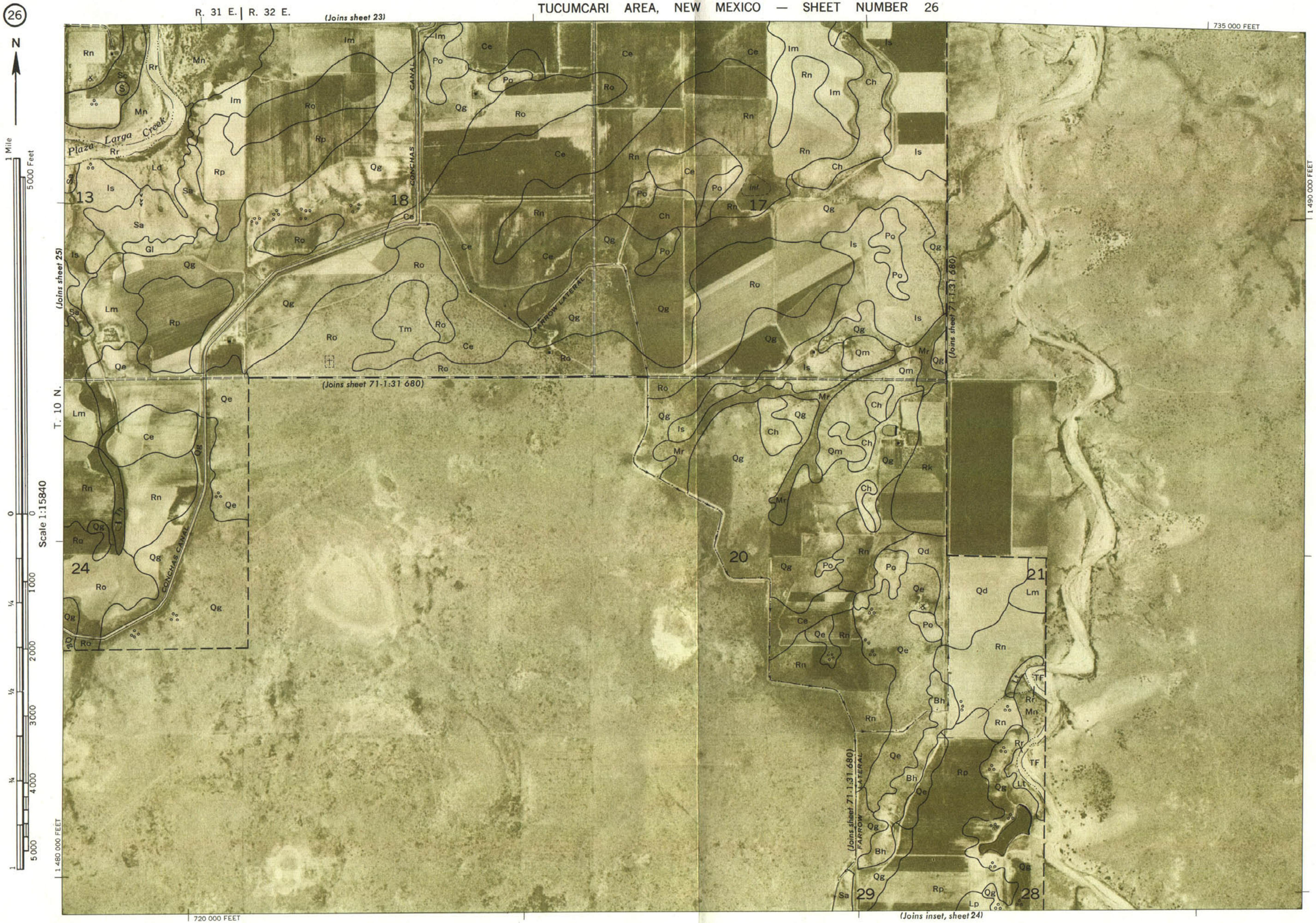
4 000 AND 5 000-FOOT GRID TICKS

Scale 1:15840

1 Mile

5000 Feet

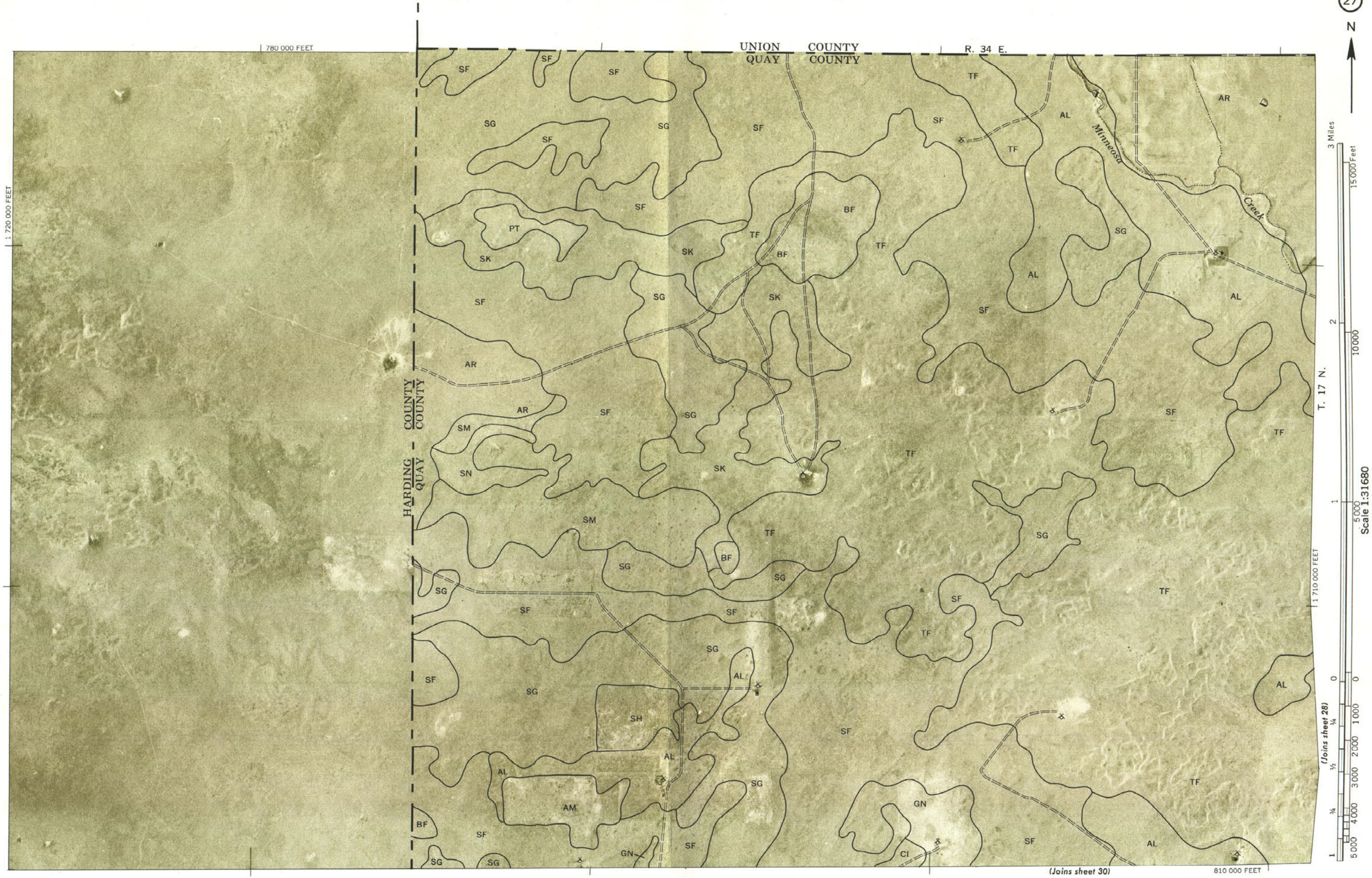
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

N

R. 34 E. | R. 35 E.

UNION COUNTY | QUAY COUNTY

840 000 FEET

T. 17 N.

1 720 000 FEET

1 710 000 FEET

820 000 FEET

North Fork Minneosa Creek

Tyaques Creek

Traques Creek

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 31)

Scale 1:31680

3 Miles 2 1 0

15000 Feet 10000 5000 0

1 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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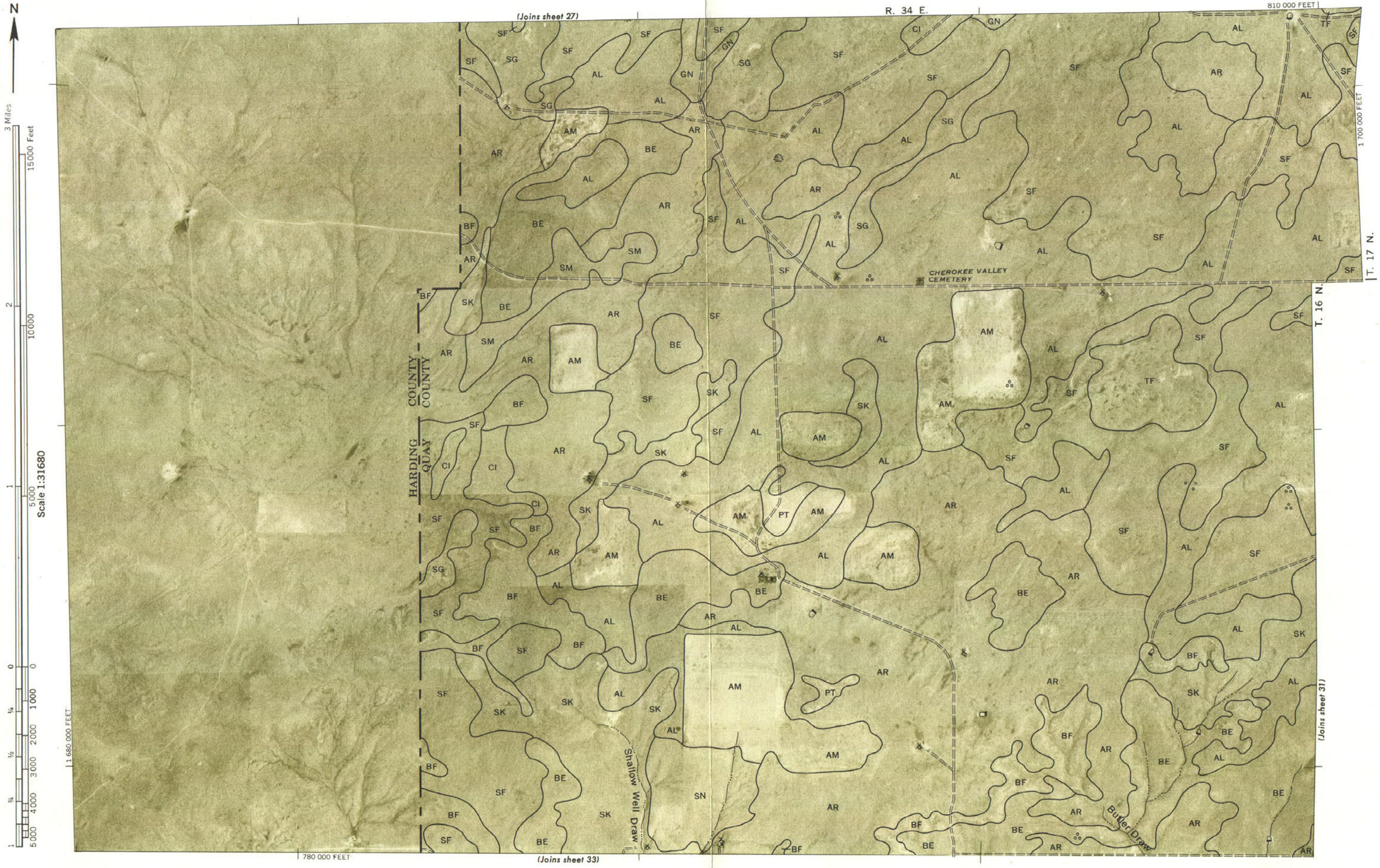
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

R. 34 E. | R. 35 E.

820 000 FEET

(Joins sheet 28)

1 700 000 FEET

T. 17 N.

T. 16 N.

(Joins sheet 30)

(Joins sheet 32)

1 680 000 FEET

(Joins sheet 34)

840 000 FEET

N

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31680

1 ¼ ½ ¾ 0 1000 2000 3000 4000 5000

Photobase from 1969 aerial photography. Positions of subsheet and township corners are approximately positioned on this map.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 33

33

N

3 Miles 2 1 0

15000 Feet 10000 5000 0

1 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 35

35

N

3 Miles

15 000 Feet

10000

5000

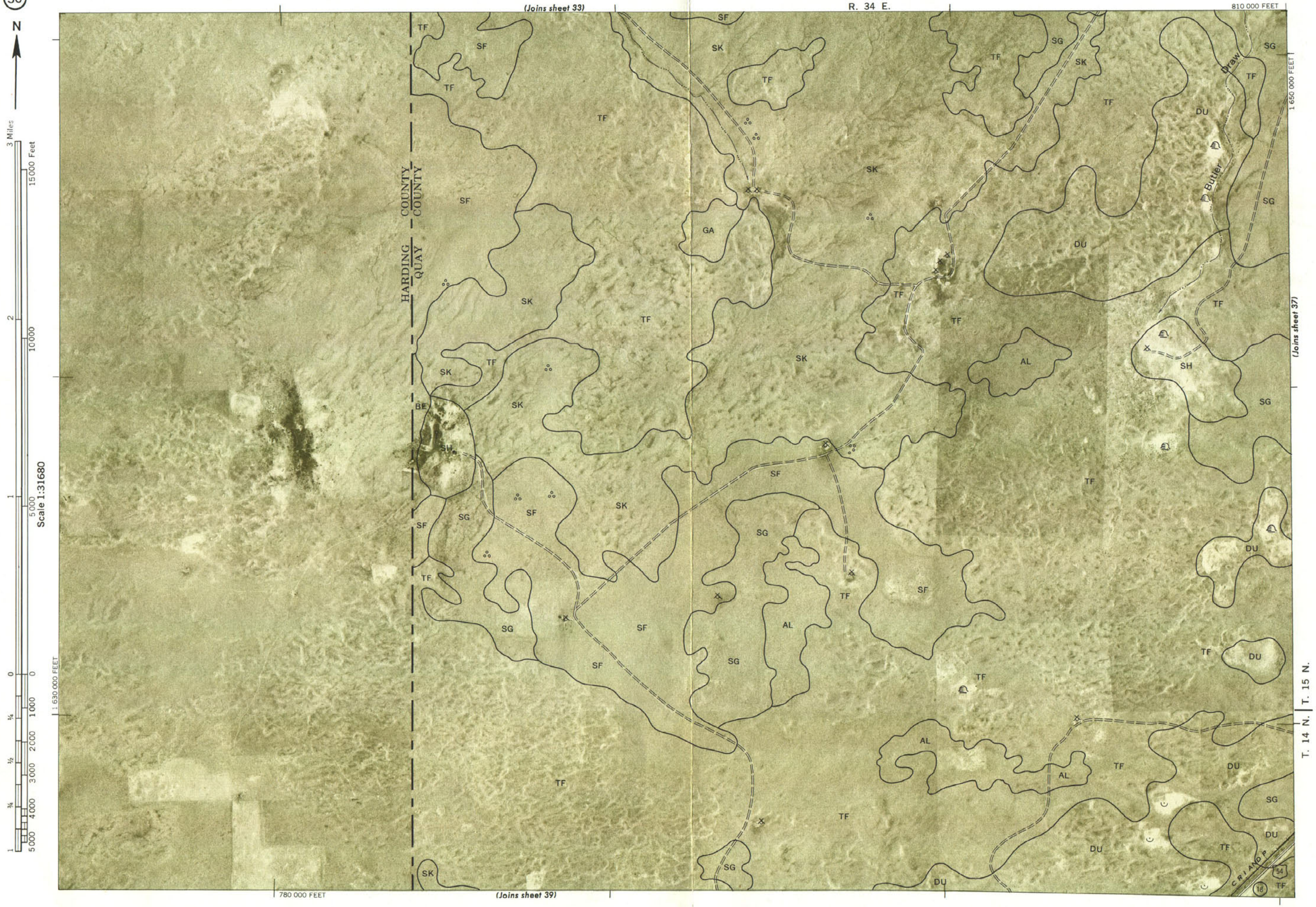
Scale 1:31680

5000 4000 3000 2000 1000 0

1 ¾ ½ ¼ 0

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 36



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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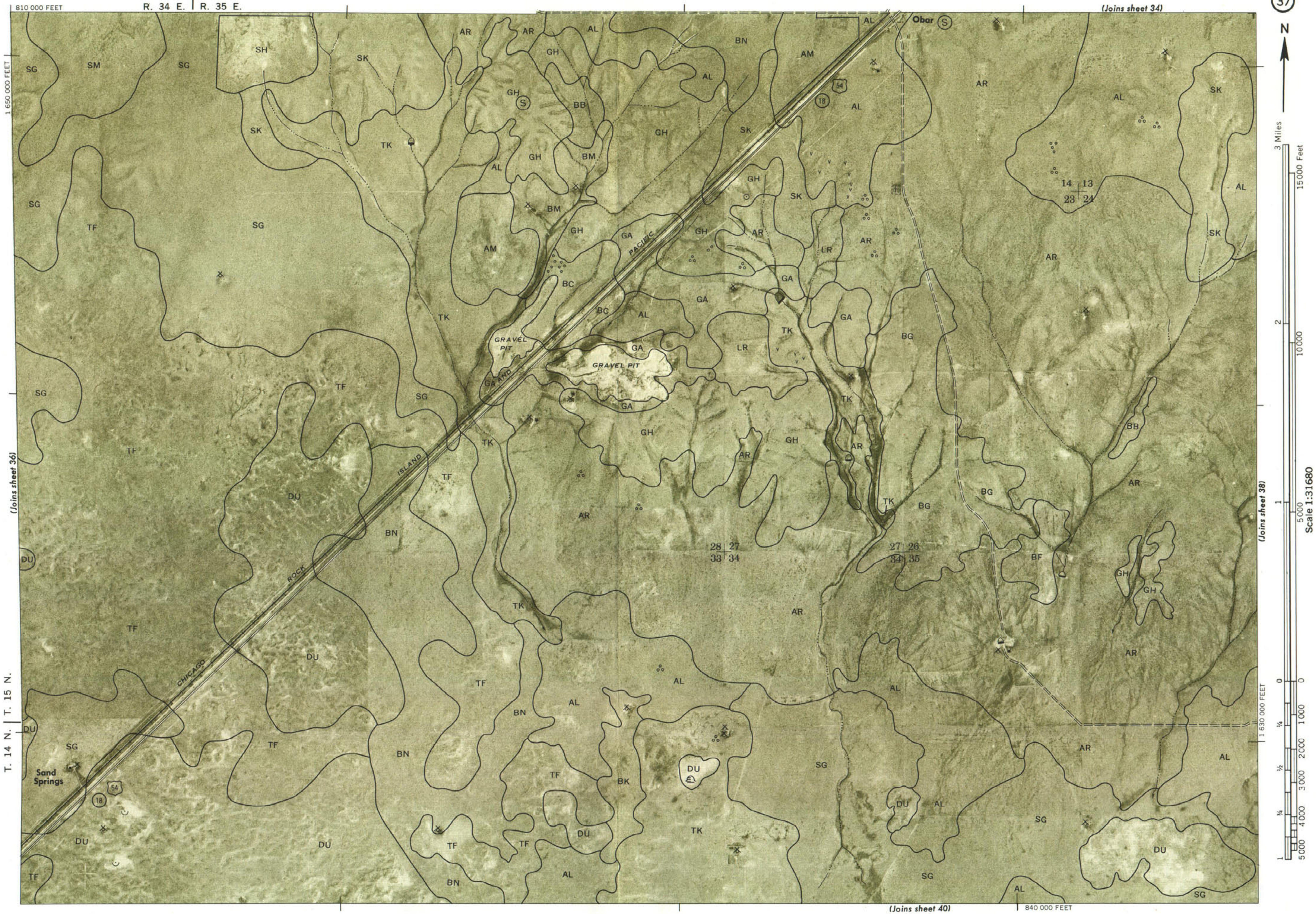
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 38

(38)

N

(Joins sheet 35)

880 000 FEET

1 650 000 FEET

3 Miles

15000 Feet

2

10000

1

5000

Scale 1:31680

(Joins sheet 37)

1 630 000 FEET

¼ 1000 0

½ 2000

¾ 4000

1 5000

850 000 FEET

(Joins sheet 41)

T. 14 N. | T. 15 N.

R. 36 E. | R. 37 E.

NEW MEXICO

TEXAS

COUNTY

COUNTY

QUAY

OLDHAM

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 39

39

780 000 FEET

R. 34 E.

(Joins sheet 36)

1 620 000 FEET

T. 14 N.

HARDING COUNTY

QUAY COUNTY

PACIFIC AND ROCK ISLAND

CHICAGO

CANADIAN RIVER

(Joins sheet 40)

(Joins sheet 44)

1 600 000 FEET

810 000 FEET

N

3 Miles

15 000 Feet

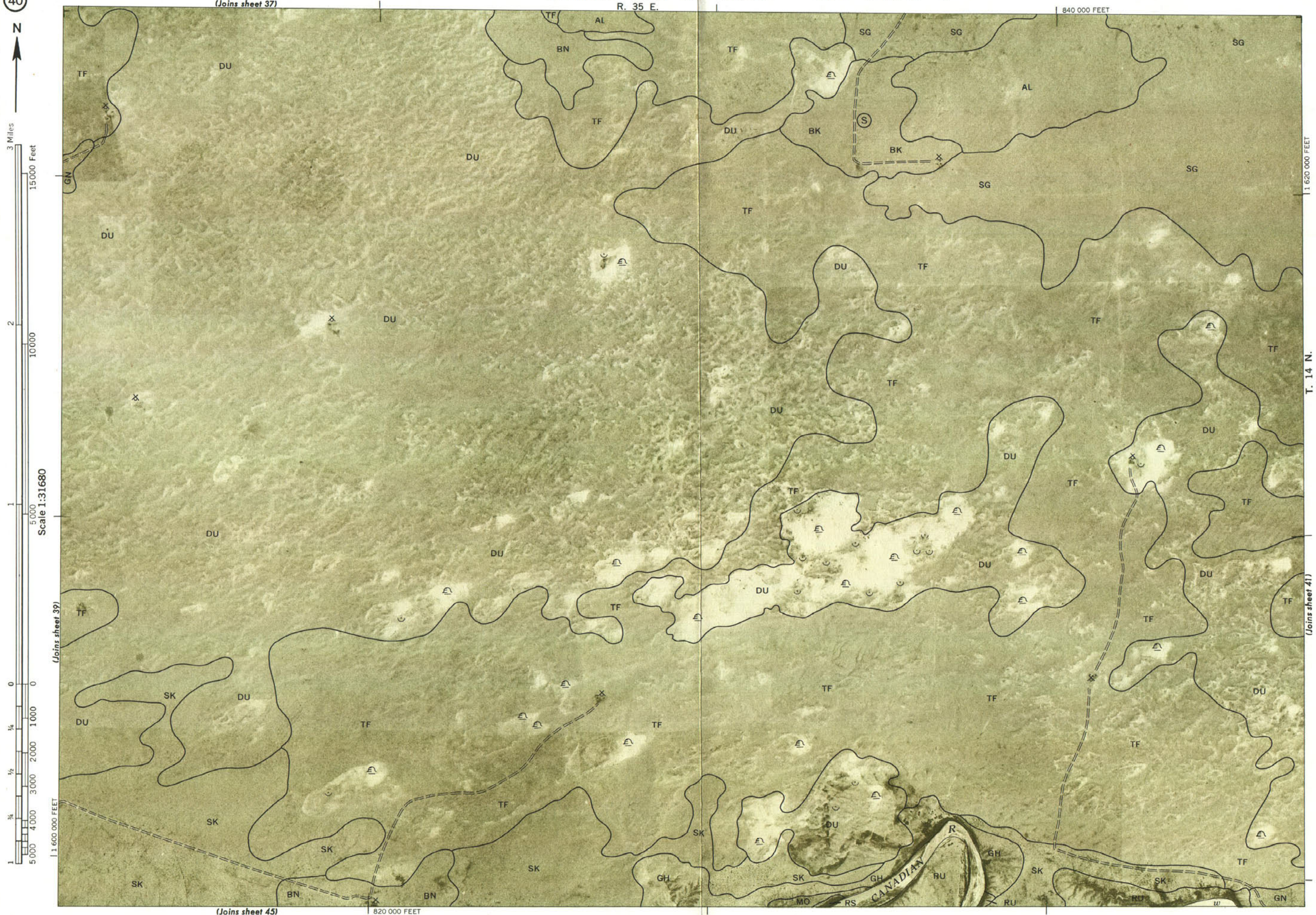
5,000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

(40)

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 40



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 41

41

N

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31680

1 ½ 0 1000 2000 3000 4000 5000

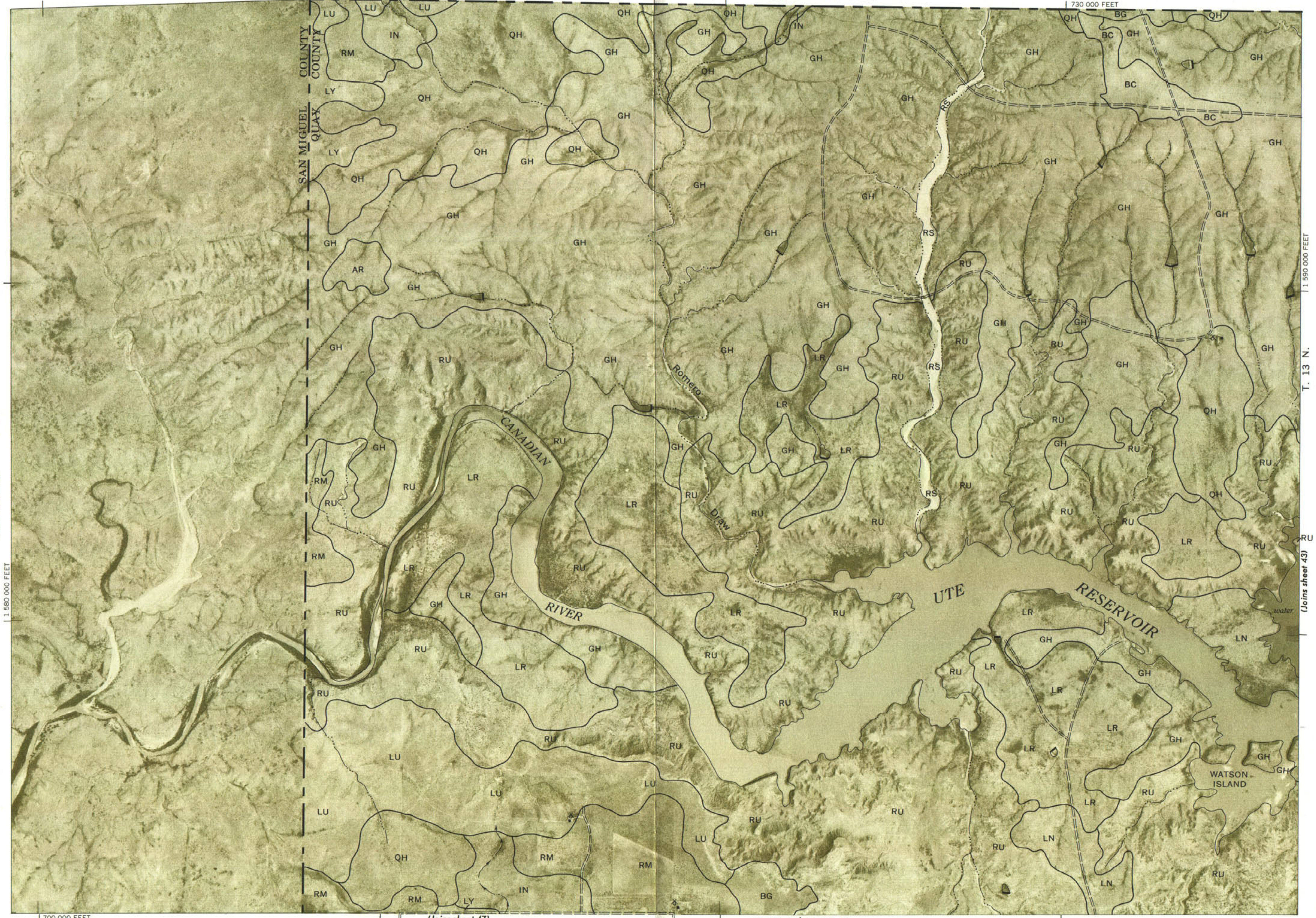
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 42

N

Scale 1:31680

Miles	Feet
3	15 000
2	10 000
1	5 000
0	0
1/4	1000
1/2	2000
	3000
3/4	4000
1	5000



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 44

(44)

HARDING COUNTY

R. 33 E. | R. 34 E.

(Joins sheet 39)

810 000 FEET

T. 13 N.

1 590 000 FEET

1 580 000 FEET

(Joins sheet 43)

(Joins sheet 45)

(Joins sheet 49)

780 000 FEET

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

0 0 1000 2000 3000 4000 5000

1/4 1/2 3/4 1

CANADIAN RIVER

LOGAN CEMETERY

GRAVEL PIT

Logan

PACIFIC AND ROCK ISLAND CHICAGO

Revuelto Creek

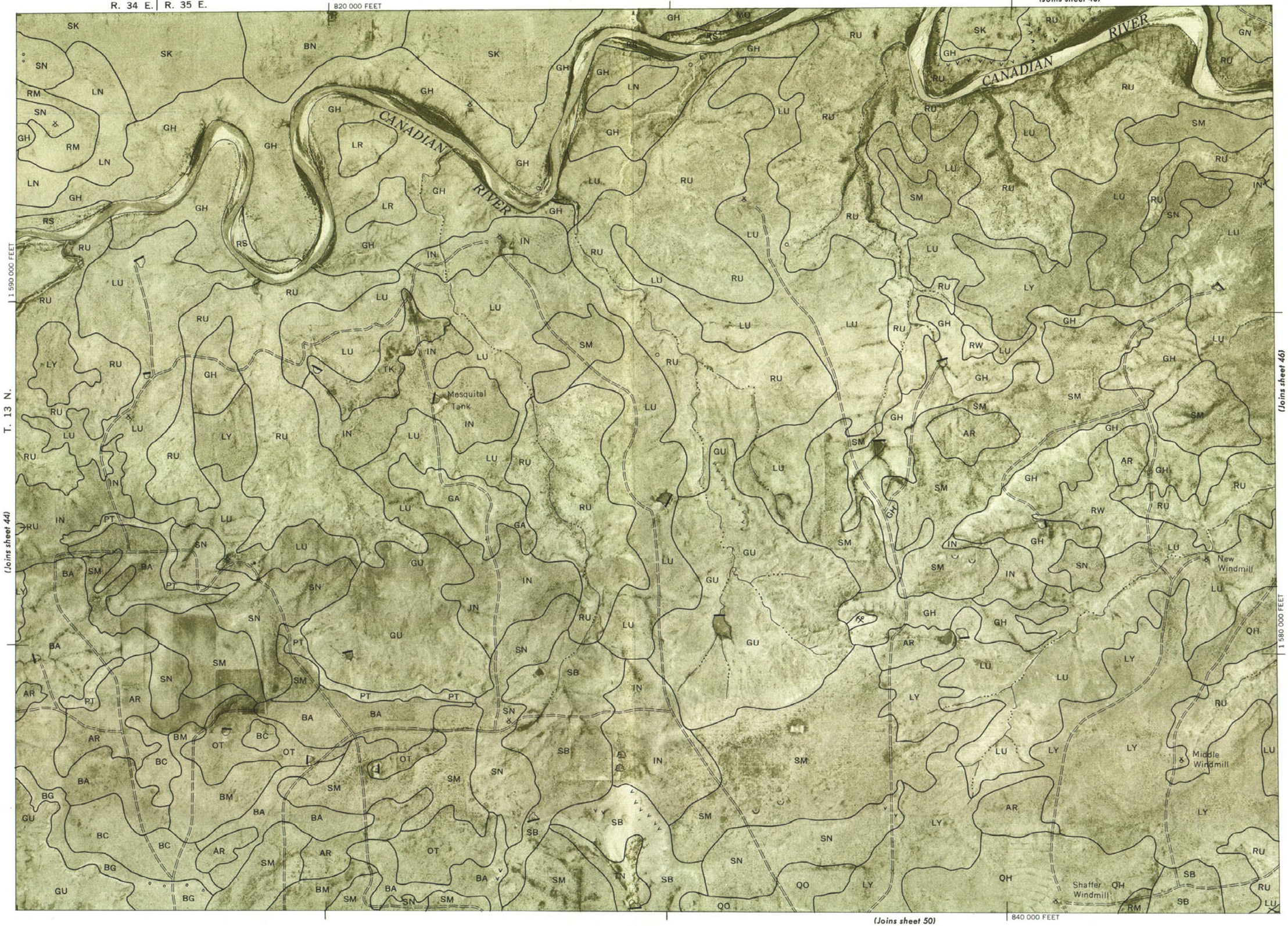
Tuscocoilo Canyon

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 45



45

N

3 Miles

15000 Feet

10000

5000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

(46)

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

5000 4000 3000 2000 1000 0

(Joins sheet 41)

R. 36 E. | R. 37 E.

880 000 FEET

1 590 000 FEET

1 580 000 FEET

850 000 FEET

(Joins sheet 45)

(Joins sheet 51)

T. 13 N.

CANADIAN RIVER

Sand Windmill

Northwest Windmill

Sissy Windmill

Snake Windmill

River Windmill

Rana Arroyo

Marlin Draw

NEW MEXICO

TEXAS

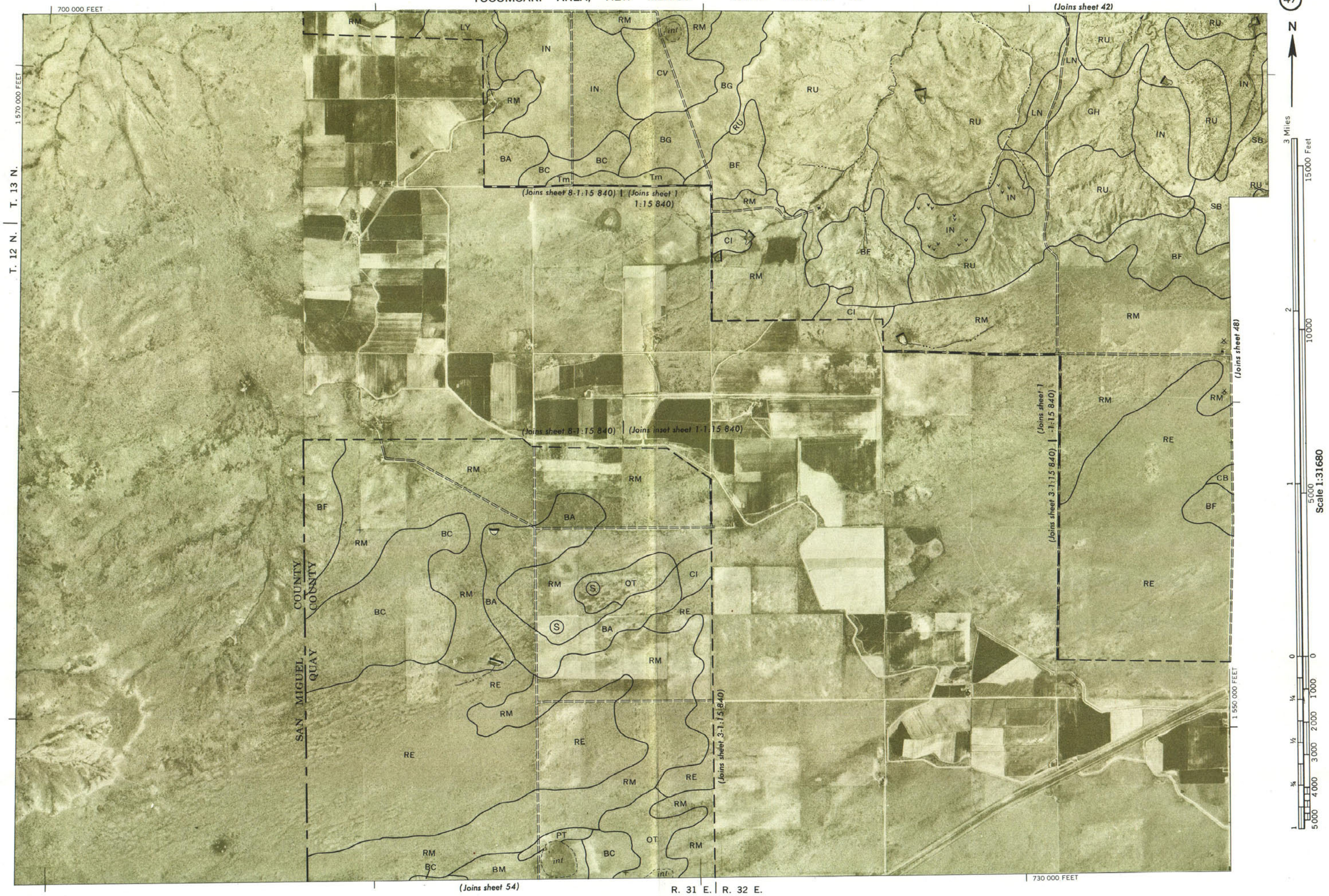
QUAY COUNTY

OLDHAM COUNTY

Land division corners are approximately positioned on this map.

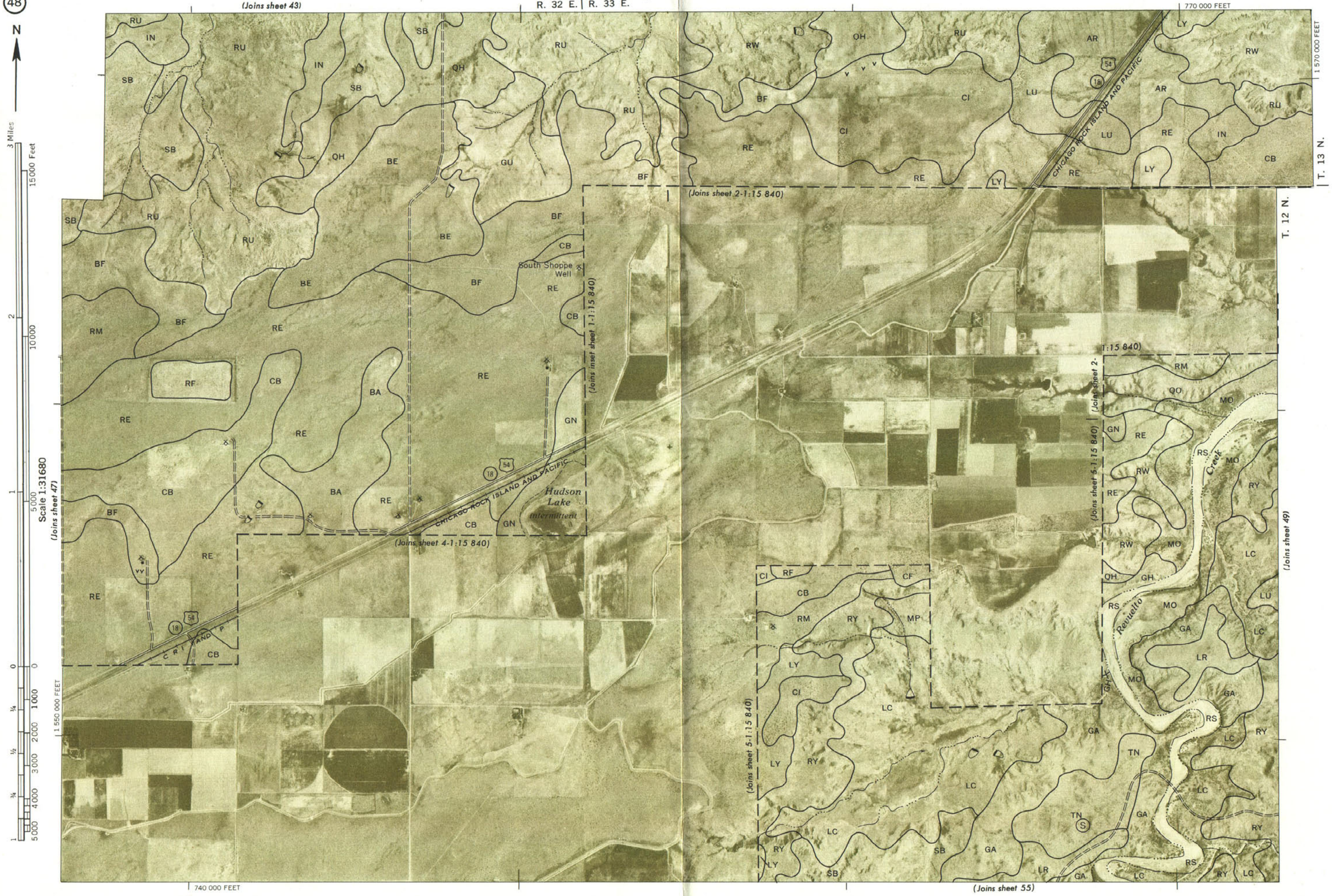
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

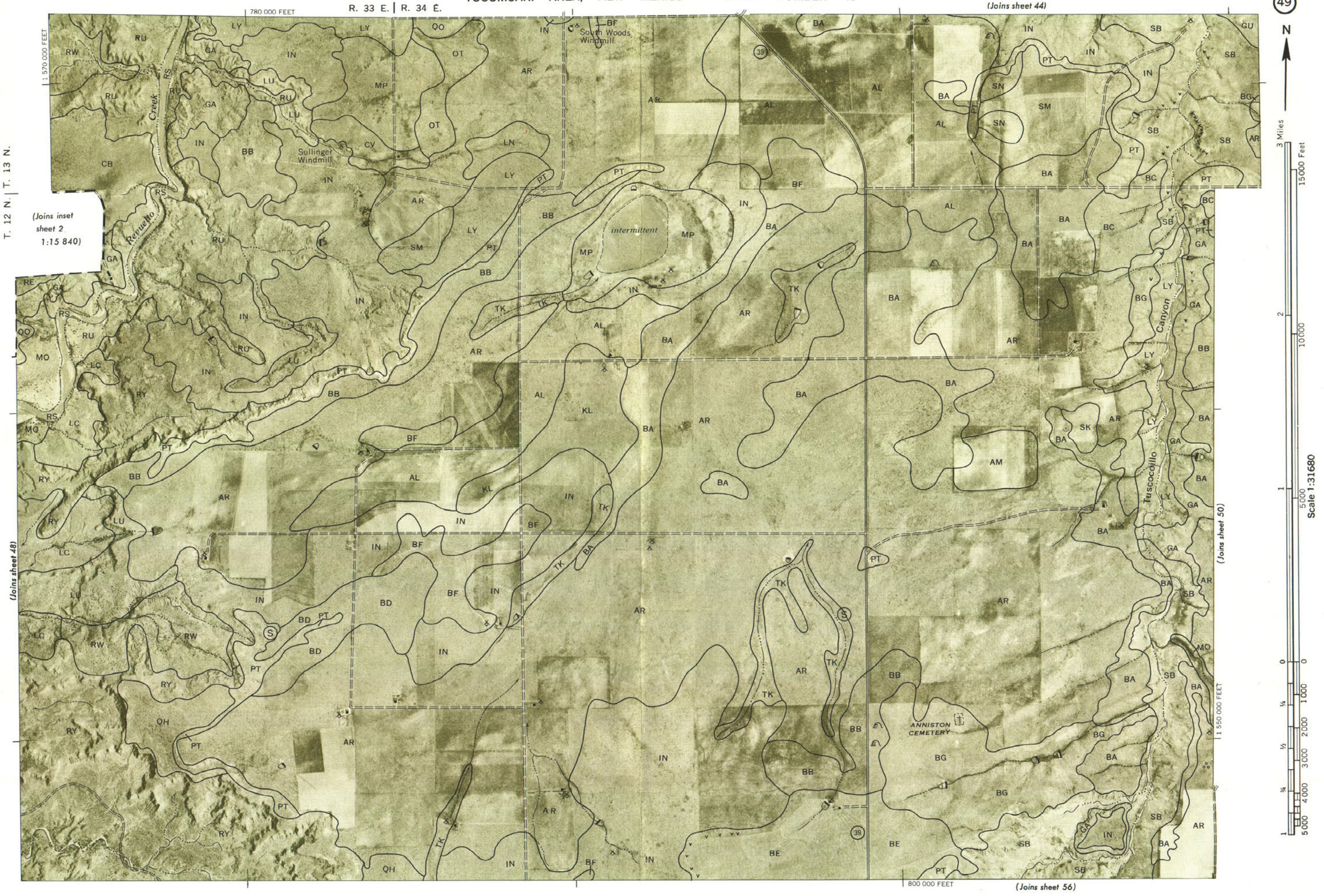
TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 48



Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station. Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone. Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 50

(50)

N

R. 34 E. | R. 35 E.

(Joins sheet 45)

840 000 FEET

1 570 000 FEET

T. 12 N. | T. 13 N.

Johnson Windmill

Lackey Windmill

Rana Arroyo

Frost Creek

(Joins sheet 49)

(Joins sheet 51)

1 550 000 FEET

810 000 FEET

(Joins sheet 57)

3 Miles 2 1 0 15000 Feet 10000 5000 0

1 ¾ ½ ¼ 0 5000 4000 3000 2000 1 000 0 5,000 Scale 1:31680

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 51

(51)

850 000 FEET

R. 36 E. | R. 37 E.

(Joins sheet 46)

1 570 000 FEET

T. 12 N. | T. 13 N.

(Joins sheet 50)

(Joins sheet 58)

880 000 FEET

1 550 000 FEET

N

QUAY COUNTY NEW MEXICO

OLDHAM COUNTY TEXAS

Smithers Windmill

Southwest Windmill

Arroyo

Rana

3 Miles

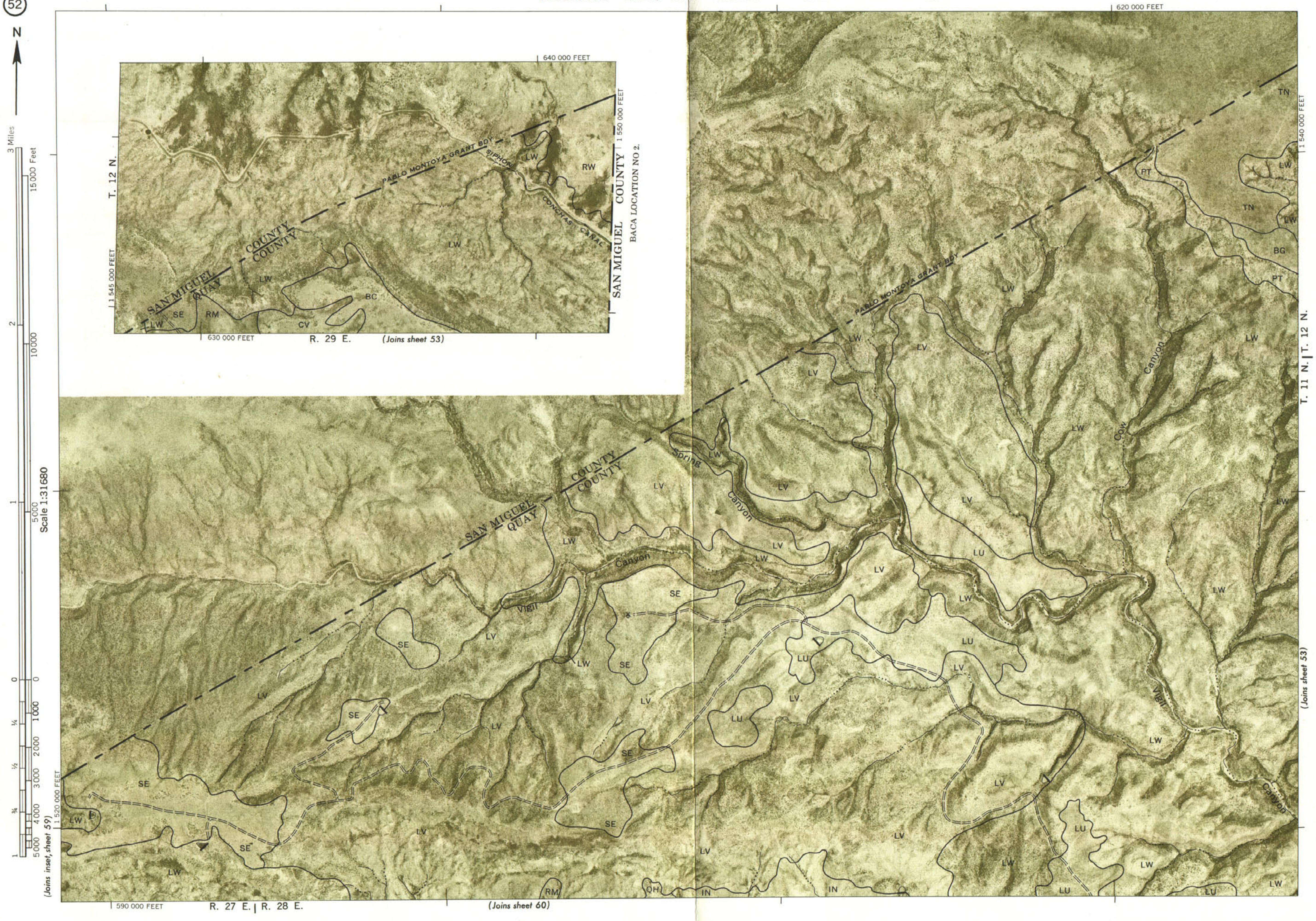
15000 Feet

10000

5000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



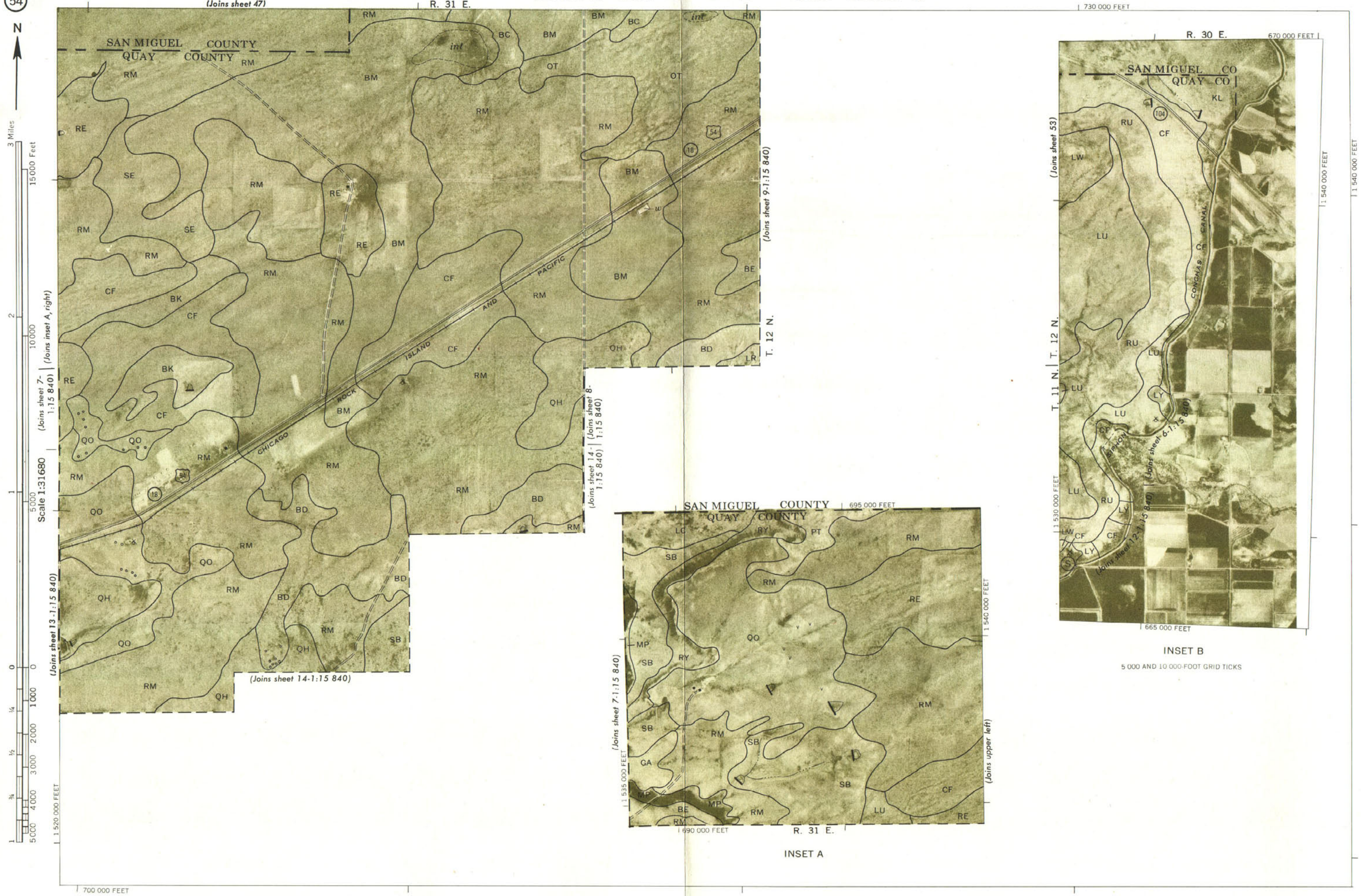
Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 53

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

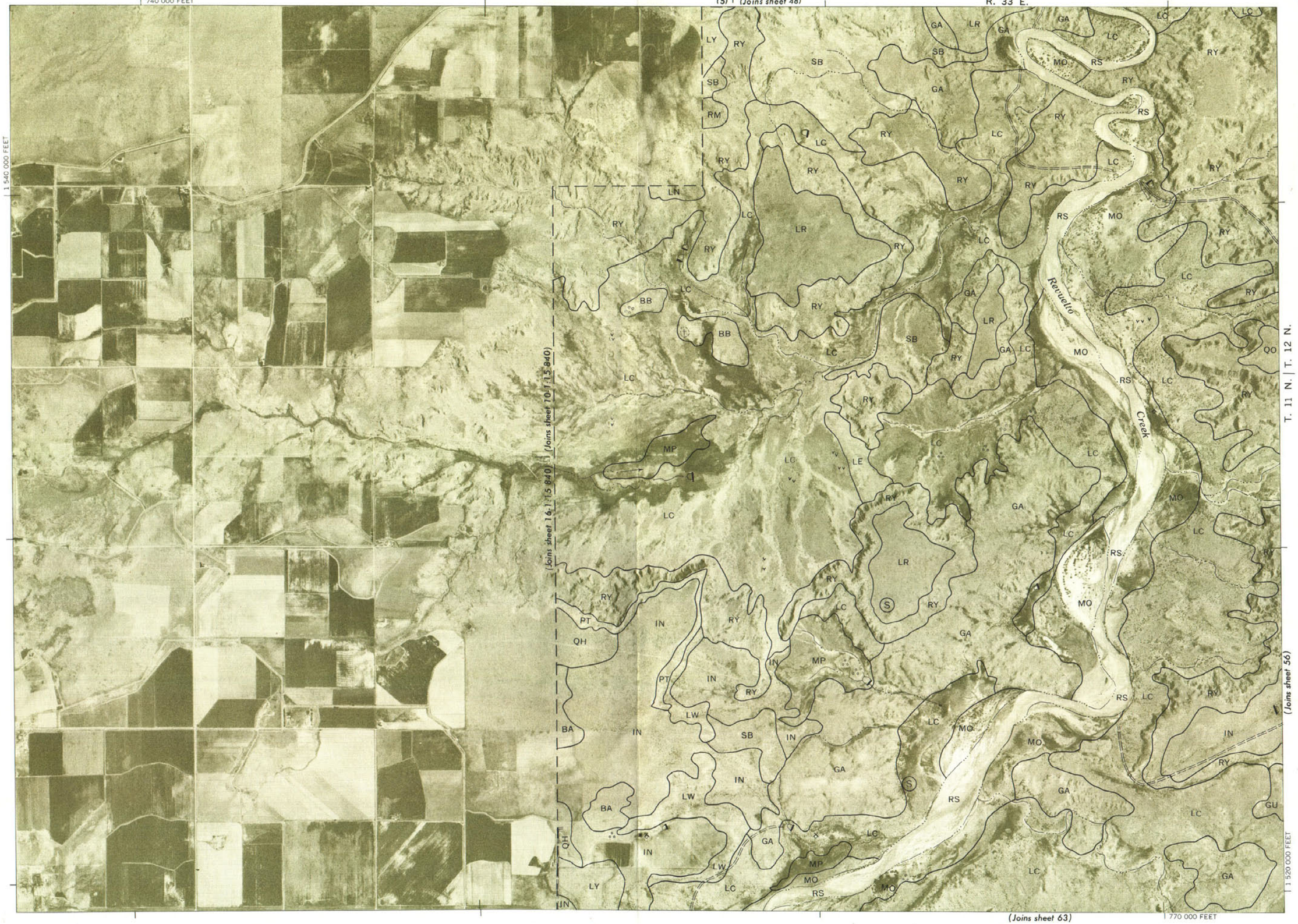


Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

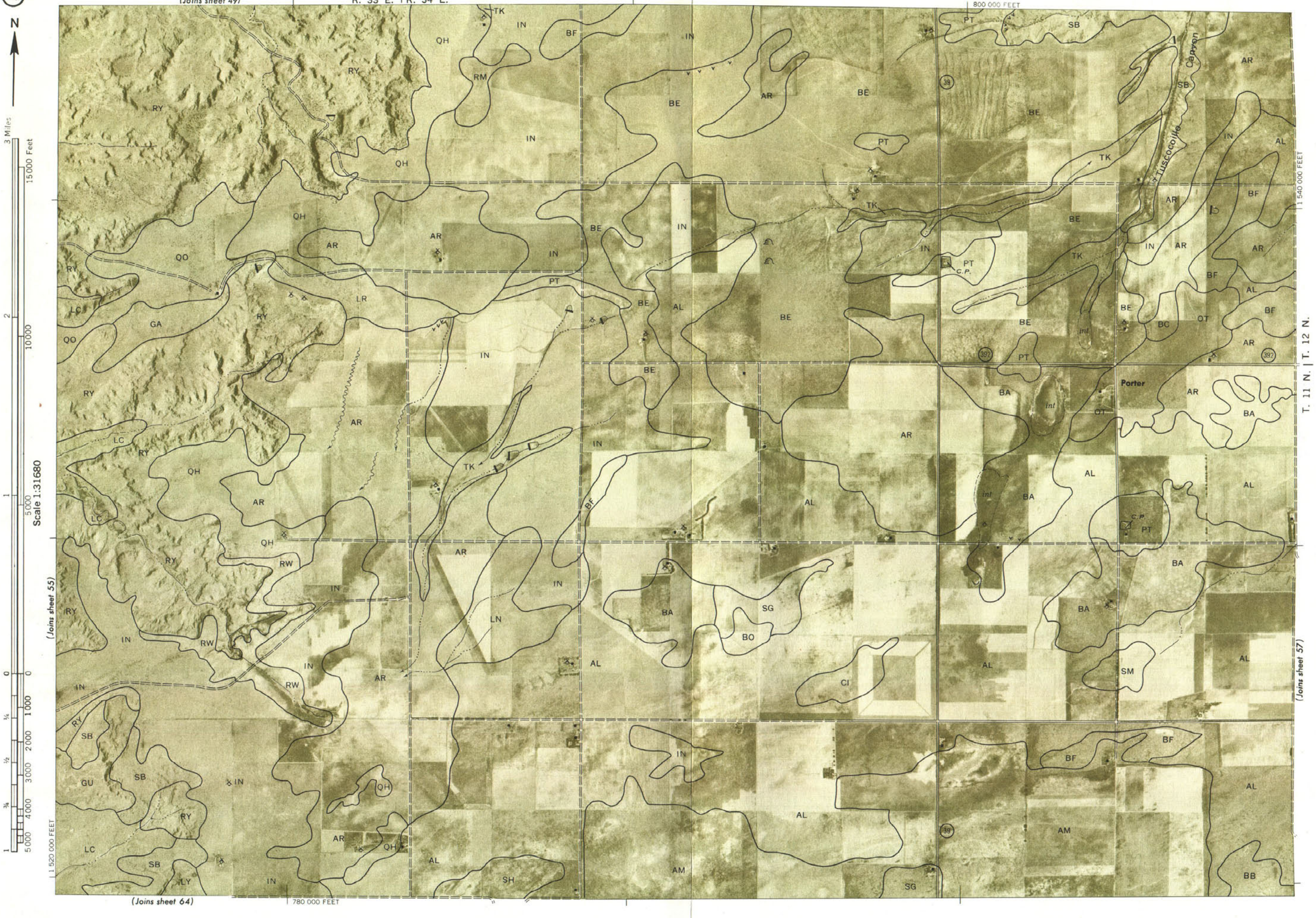
TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 55



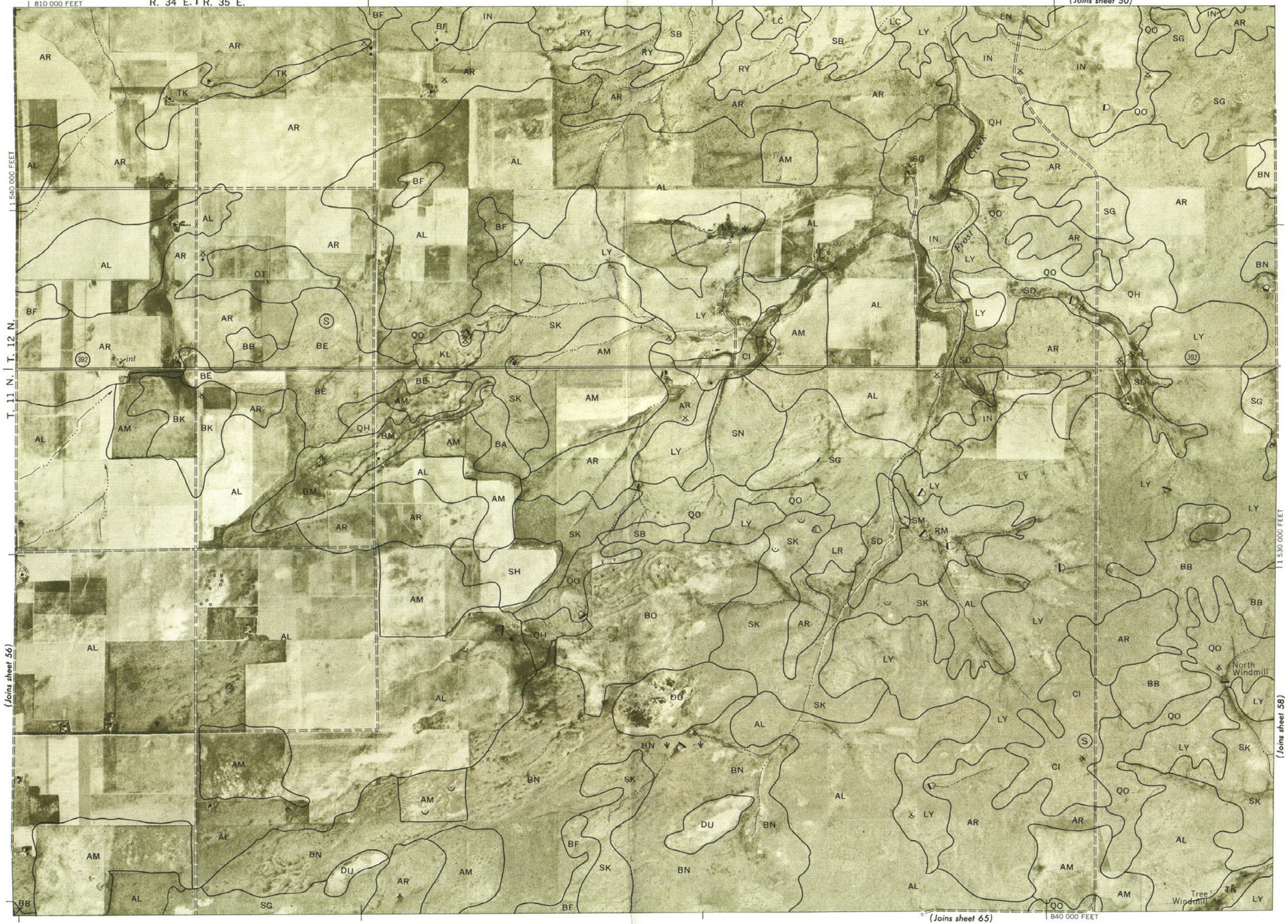
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

56

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 56



TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 57



57

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

5000 4000 3000 2000 1000 0

¼ ½ ¾ 1

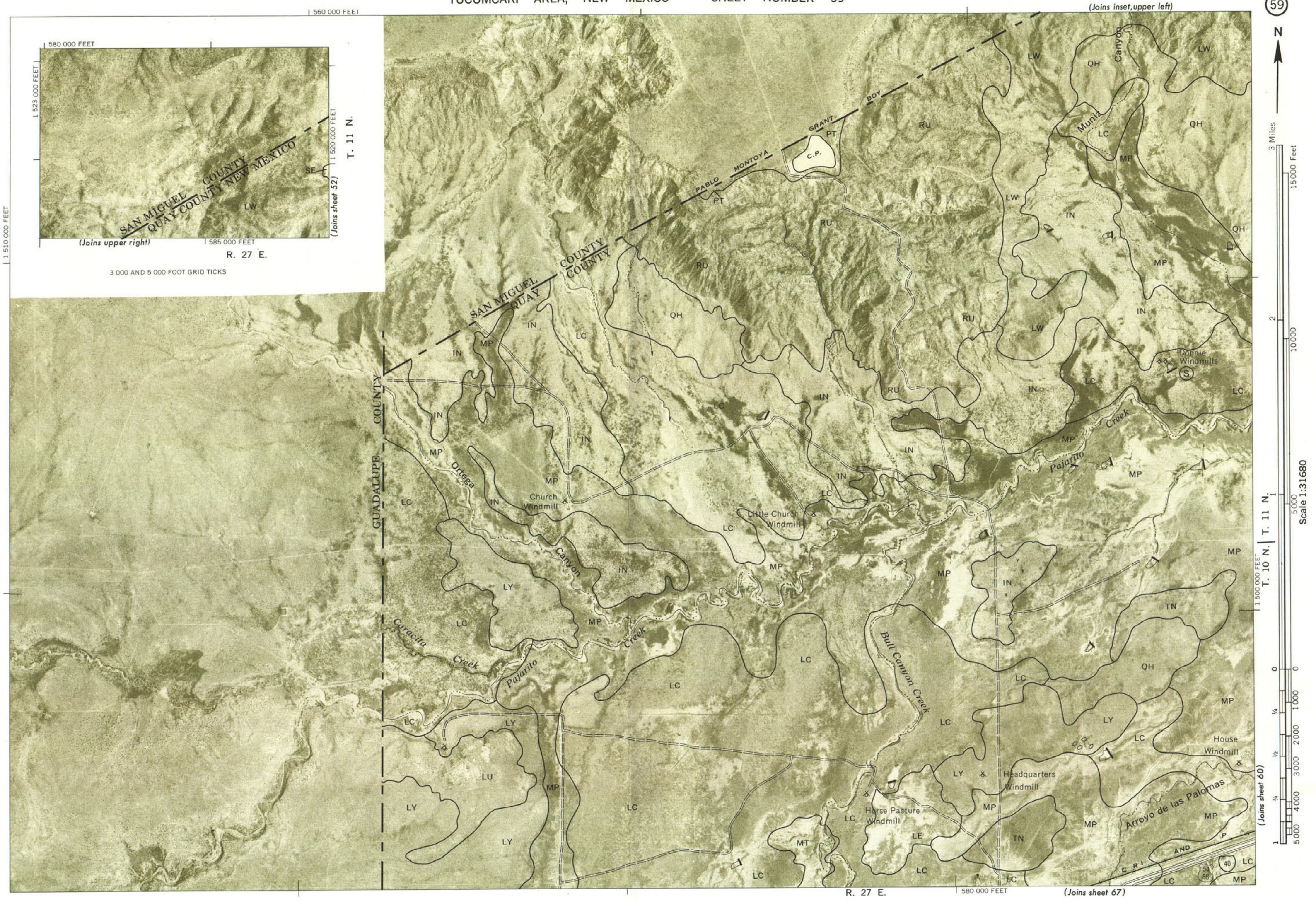
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 58

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

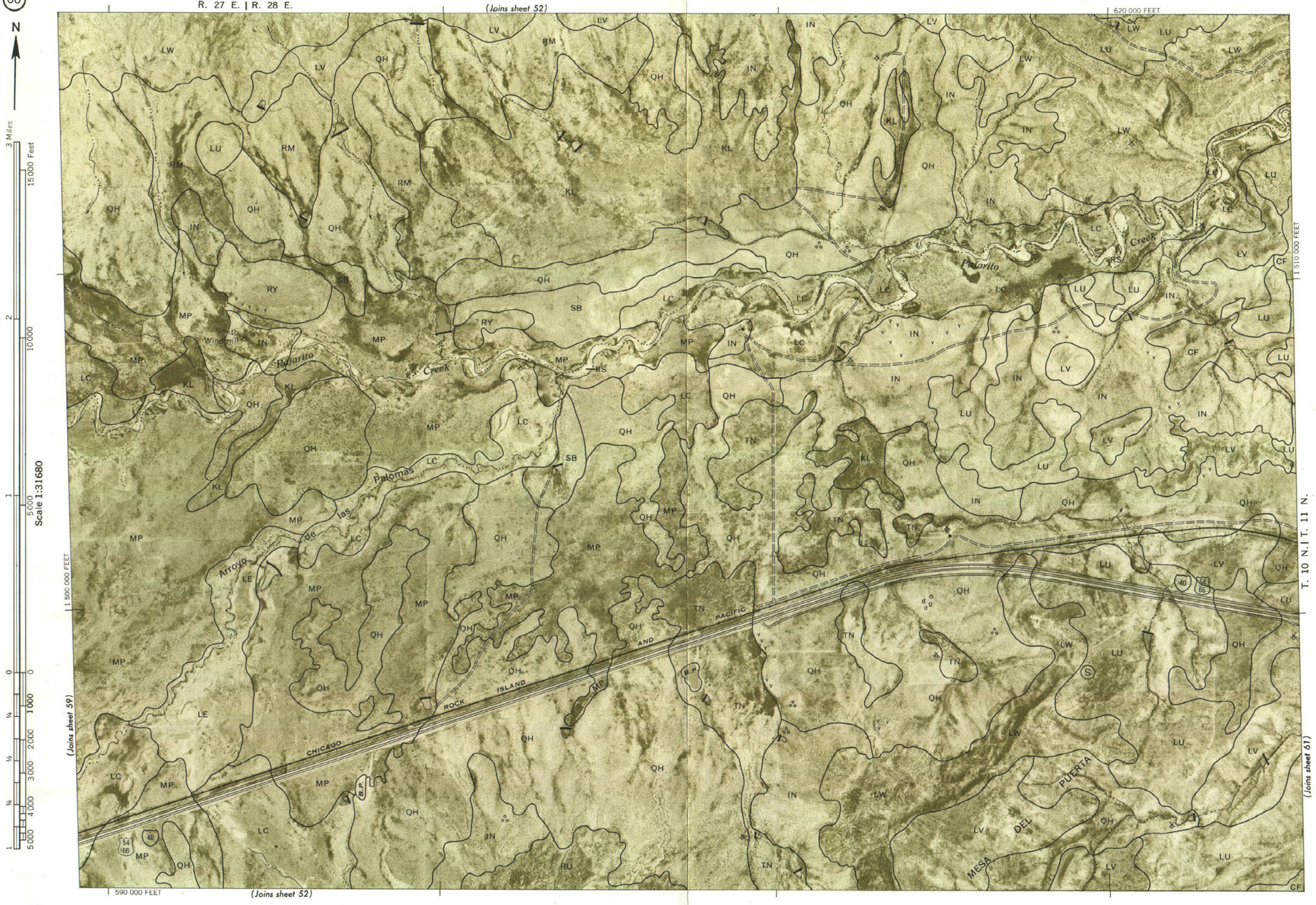
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

Land division corners are approximately positioned on this map.


R. 27 E. | R. 28 E.
(Joins sheet 52)
620 000 FEET
1 510 000 FEET
T. 10 N. | T. 11 N.
(Joins sheet 61)
(Joins sheet 52)
590 000 FEET
(Joins sheet 59)
1 500 000 FEET
N
3 Miles
15 000 Feet
10 000
5 000
Scale 1:31680
Smith Windmill
Pajarito
Creek
Arroyo de las Palomas
CHICAGO ROCK ISLAND AND PACIFIC
MESA DEL PUERTA
40
54
66
LW
LV
RM
QH
IN
KL
LU
RY
SB
MP
LC
RS
CF
TN
LE
B.P.
RU
S

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 61

61

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

1 ¼ ½ ¾ 0 1000 2000 3000 4000 5000

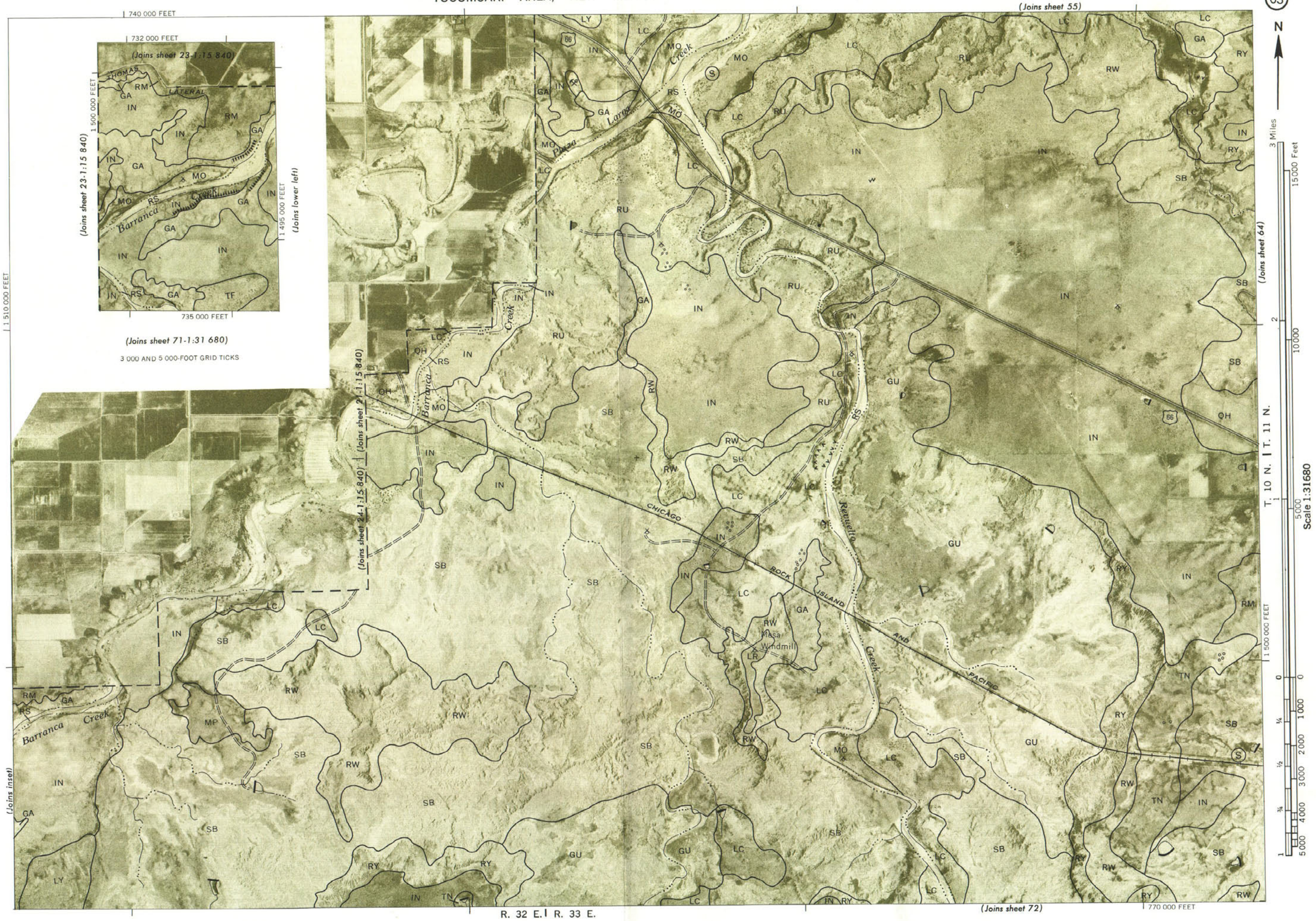
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 62

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station. Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 64

64

N

(Joins sheet 56)

R. 33 E. | R. 34 E.

T. 10 N. | T. 11 N.

1 510 000 FEET

1 500 000 FEET

780 000 FEET

800 000 FEET

(Joins sheet 63)

(Joins sheet 65)

(Joins sheet 73)

San Jon

CHICAGO ROCK ISLAND AND PACIFIC

SEWAGE DISPOSAL

San Jon Creek

Scale 1:31680

3 Miles 2 1 0 15000 Feet 10000 5000

1 ¾ ½ ¼ 0 5000 4000 3000 2000 1000 0

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 65

65

N

3 Miles

15 000 Feet

10000

5000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land civision corners are approximately positioned on this map.

N

(Joins sheet 58)

R. 36 E. | R. 37 E.

880 000 FEET

1 520 000 FEET

T. 10 N. | T. 11 N.

1 500 000 FEET

850 000 FEET

(Joins sheet 65)

(Joins sheet 75)

NEW MEXICO — TEXAS

QUAY COUNTY | DEAF SMITH COUNTY

Endee

Sand Point Draw

Martha Creek

Trujillo Creek

San Jon Creek

Arroyo

ROCK ISLAND AND PACIFIC

CHICAGO

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 67

67

560 000 FEET

R. 27 E.

(Joins sheet 59)

1 490 000 FEET

Montoya

PACIFIC AND CHICAGO ROCK ISLAND

54 66 40

GUADALUPE COUNTY — QUAY COUNTY

T. 9 N. | T. 10 N.

Bull Creek

Canyon

Sunflower Canyon

Captivas Canyon

Palomas Mesa

LY LU MP LC MT LE SB QH KL RM TN RU RW PT OT LR

1 470 000 FEET

580 000 FEET

(Joins sheet 76)

(Joins sheet 68)

N

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31680

1 5000 ¾ 4000 ½ 3000 ¼ 2000 0 1000 0

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

N

R. 27 E. | R. 28 E.

(Joins sheet 60)

620 000 FEET

1 490 000 FEET

Palomas Hills

MESA DEL PUERTA

Blanca Creek

Quemado Hills

P A L O M A S M E S A

(Joins sheet 67)

(Joins sheet 69)

1 470 000 FEET

590 000 FEET

(Joins sheet 77)

T. 9 N. | T. 10 N.

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31680

1 5000 ¾ 4000 ½ 3000 ¼ 2000 0 1000 0 5000

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map

(70)

N

R. 30 E. | R. 31 E.

690 000 FEET

1 490 000 FEET

(Joins sheet 62)

Bulldog Mesa

Larga Creek

Plaza Creek

Apodaca Creek

T. 9 N. | T. 10 N.

1 470 000 FEET

670 000 FEET

(Joins sheet 69)

(Joins sheet 71)

(Joins sheet 79)

Scale 1:31680

3 Miles 2 1 0 15000 Feet 10000 5000

1 ¾ ½ ¼ 0 5000 4000 3000 2000 1000 0

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 71

71

N

3 Miles 2 1

15 000 Feet 10000 5000 0

Scale 1:31680

1 5000 ¾ 4000 ½ 3000 ¼ 2000 0 1000

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

N

Scale 1:31680

3 Miles 2 1 0 15000 Feet 10000 0

5000 4000 3000 2000 1000 0 5000

(Joins sheet 63)

(Joins sheet 71)

(Joins sheet 81)

(Joins sheet 73)

770 000 FEET

1 490 000 FEET

1 470 000 FEET

740 000 FEET

R. 32 E. | R. 33 E.

T. 9 N. | T. 10 N.

Reuneto Creek

Saladito Creek

Bedford Spring

Bedford Hill

Joe Keyes Tank

Reuneto Creek

int

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 73

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

(74)

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 74

N

Scale 1:31680

3 Miles, 2, 1, 0, 1/4, 1/2, 3/4, 1

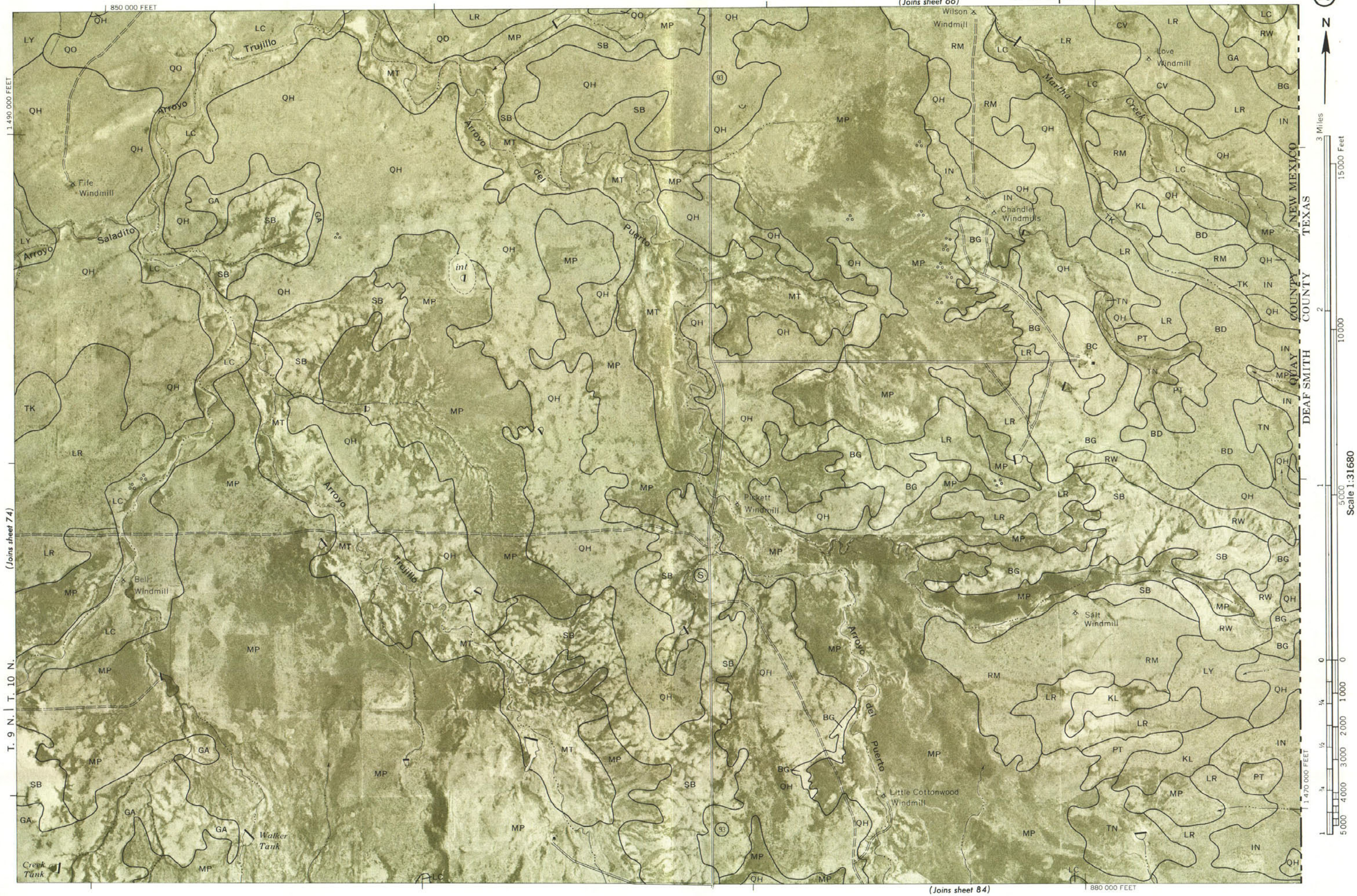
15000 Feet, 10000, 5000, 0, 1000, 2000, 3000, 4000, 5000

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 76

76

N

3 Miles

15000 Feet

2

10000

1

5000

Scale 1:31680

580 000 FEET

(Joins sheet 67)

1 460 000 FEET

GUADALUPE COUNTY

QUAY COUNTY

Captivas Peak

Captivas Canyon

Sunflower Canyon

Darnell Canyon

LIMIT OF DETAILED SOIL SURVEY

QH

LC

SB

RU

RM

IN

TN

LY

T. 9 N.

R. 27 E.

1 440 000 FEET

560 000 FEET

(Joins sheet 77)

(Joins sheet 85)

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 77

590 000 FEET

(Joins sheet 68)

77

N

1 460 000 FEET

T. 9 N.

Charco Creek

(Joins sheet 78)

(Joins sheet 76)

LIMIT OF DETAILED SOIL SURVEY

(Joins 85) | (Joins sheet 86)

R. 27 E. | R. 28 E.

620 000 FEET

(Joins sheet 86) | (Joins 87)

1 440 000 FEET

3 Miles 2 1 0 1

15000 Feet 10000 5000 0

Scale 1:31680

¼ ½ ¾ 1

1000 2000 3000 4000 5000

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 78

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 80

(80)

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

0 0 ¼ ½ ¾ 1

1000 2000 3000 4000 5000 FEET

(Joins sheet 71)

R. 31 E. | R. 32 E.

730 000 FEET

1 460 000 FEET

T. 9 N.

(Joins sheet 79)

(Joins sheet 81)

1 440 000 FEET

700 000 FEET

(Joins sheet 89) | (Joins 90)

MESA REDONDA

Rincon Creek

Barranca Creek

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 81

R. 32 E. | R. 33 E.

(Joins sheet 72)

740 000 FEET

1 460 000 FEET

T. 9 N.

(Joins sheet 80)

(Joins sheet 82)

(Joins sheet 90)

1 440 000 FEET

770 000 FEET

Saladito Creek

Redwater Creek

Saladito Creek

SOIL SURVEY OF DETAILED MAP LIMIT

81

N

3 Miles

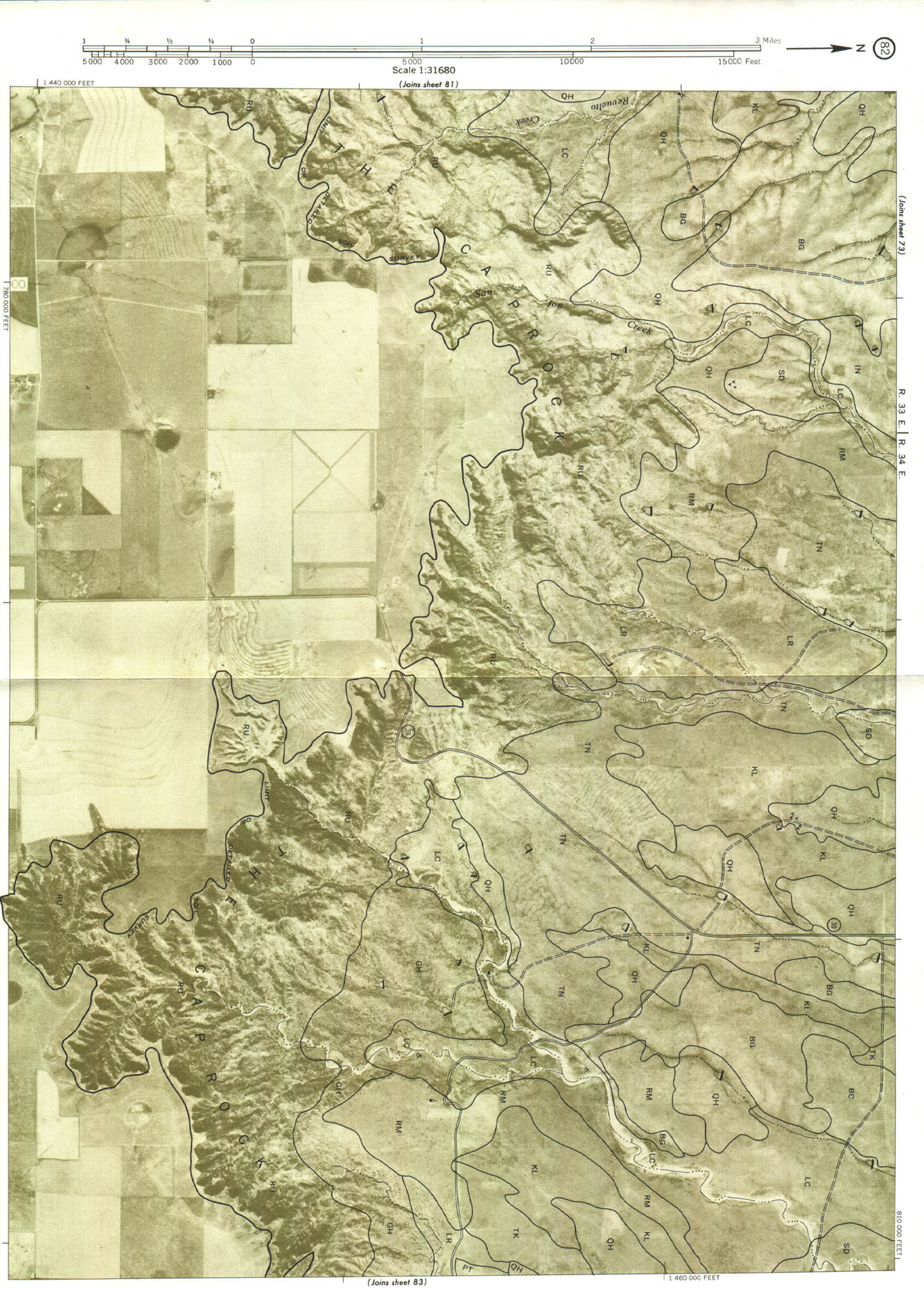
15 000 Feet

10000

5000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Protobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.



TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 82

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 83

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

R. 34 E. | R. 35 E.

820 000 FEET

(Joins sheet 74)

1 460 000 FEET

T. 9 N.

(Joins sheet 82)

LIMIT OF SOIL SURVEY

CURRY COUNTY

840 000 FEET

1 450 000 FEET

(Joins sheet 84)

83

N

3 Miles

15000 Feet

10000

5000

Scale 1:31680

(84)

N

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

1 ¼ ½ ¾ 1

0 0 1000 2000 3000 4000 5000

(Joins sheet 75)

(Joins sheet 83)

R. 36 E. | R. 37 E.

880 000 FEET

1 460 000 FEET

1 450 000 FEET

850 000 FEET

T. 9 N.

Allen Tank

NEW MEXICO — TEXAS

QUAY COUNTY

DEAF SMITH COUNTY

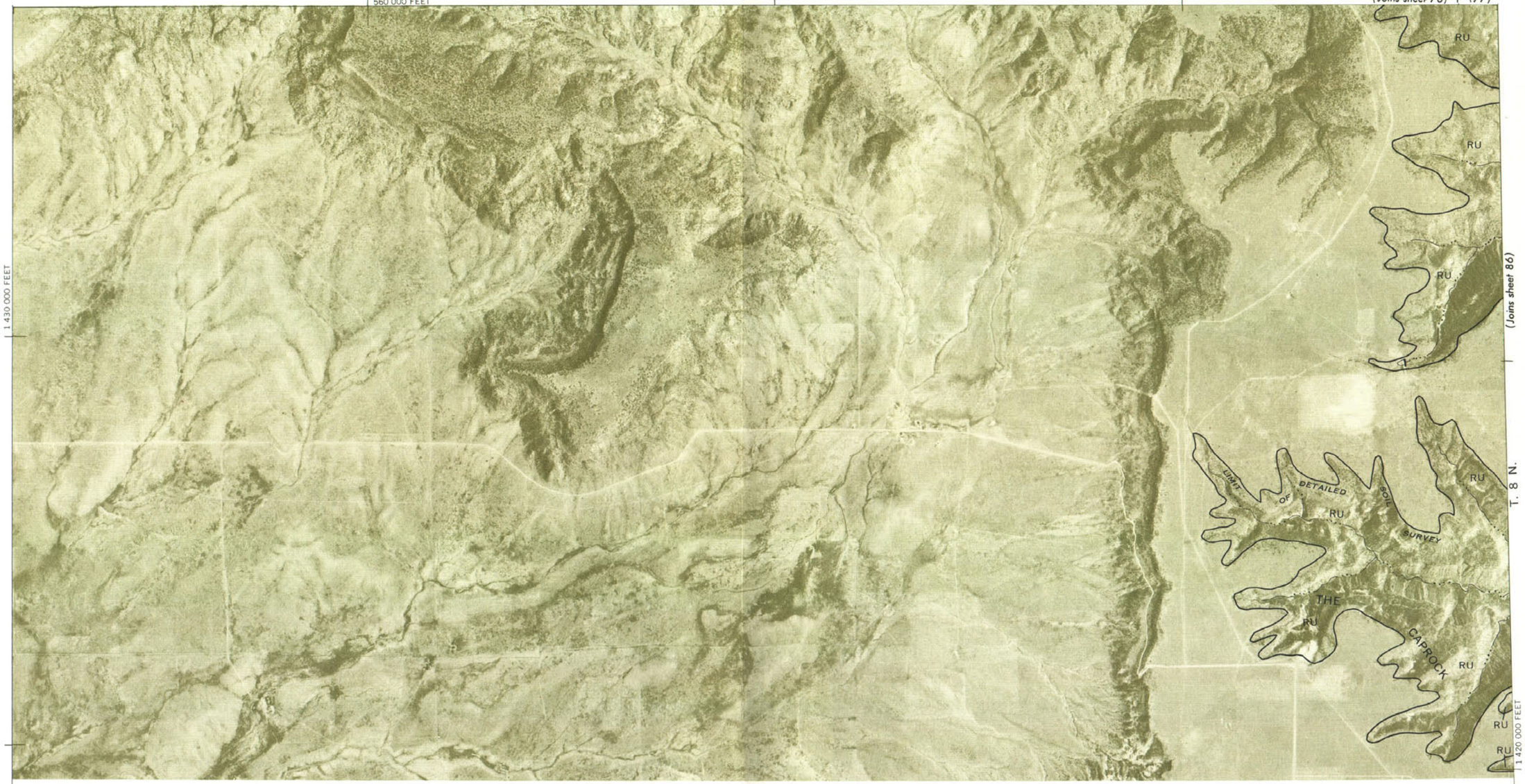
CURRY COUNTY

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 85



85

N

3 Miles

15 000 Feet

10000

5 000

Scale 1:31680

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

(86)

N

R. 27 E. | R. 28 E.

(Joins sheet 77)

620 000 FEET

T. 8 N.

1 430 000 FEET

1 420 000 FEET

590 000 FEET

(Joins sheet 85)

(Joins sheet 87)

(Joins sheet 91)

LIMIT OF DET SOIL SUR

SURVEY

LIMIT OF DETAILED SOIL SURVEY

THE CAPROCK

LIMIT OF DETAILED SOIL SURVEY

3 Miles 15000 Feet 10000 5000

Scale 1:31680

5000 4000 3000 2000 1000 0 0

1 ¾ ½ ¼ 0 1

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 87

(Joins 77) | (Joins sheet 78) | 630 000 FEET | R. 29 E. | R. 30 E. | (87)

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 88

(88)

N

(Joins 78) | (Joins sheet 79)

R. 30 E. | R. 31 E.

690 000 FEET

1 440 000 FEET

T. 8 N.

(Joins sheet 89)

1 420 000 FEET

670 000 FEET

(Joins sheet 93)

MESA REDONDA

Quay

3 Miles 2 1

15000 Feet 10000 5000

Scale 1:31680

5000 4000 3000 2000 1000 0 0

1 ¾ ½ ¼

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

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Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 89

1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31680

N

89

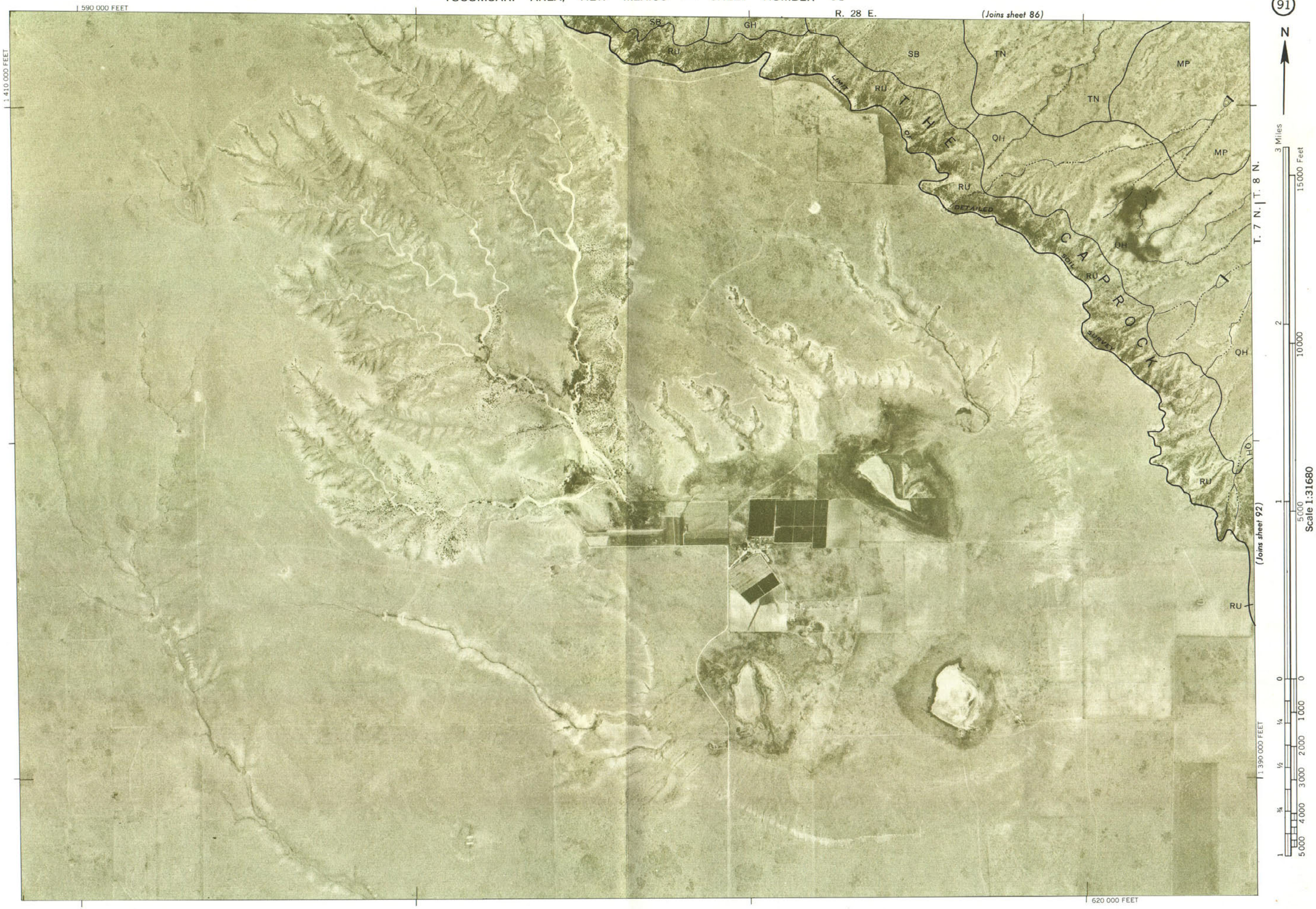
TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 90

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 91



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.
Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.
Land division corners are approximately positioned on this map.

92

TUCUMCARI AREA, NEW MEXICO — SHEET NUMBER 92

N

Scale 1:31680

3 Miles 2 1 0

15000 Feet 10000 5000

5000 4000 3000 2000 1000 0

¾ ½ ¼ 0

1 390 000 FEET

630 000 FEET

660 000 FEET

1 410 000 FEET

R. 29 E. | R. 30 E.

T. 7 N. | T. 8 N.

(Joins sheet 87)

(Joins sheet 91)

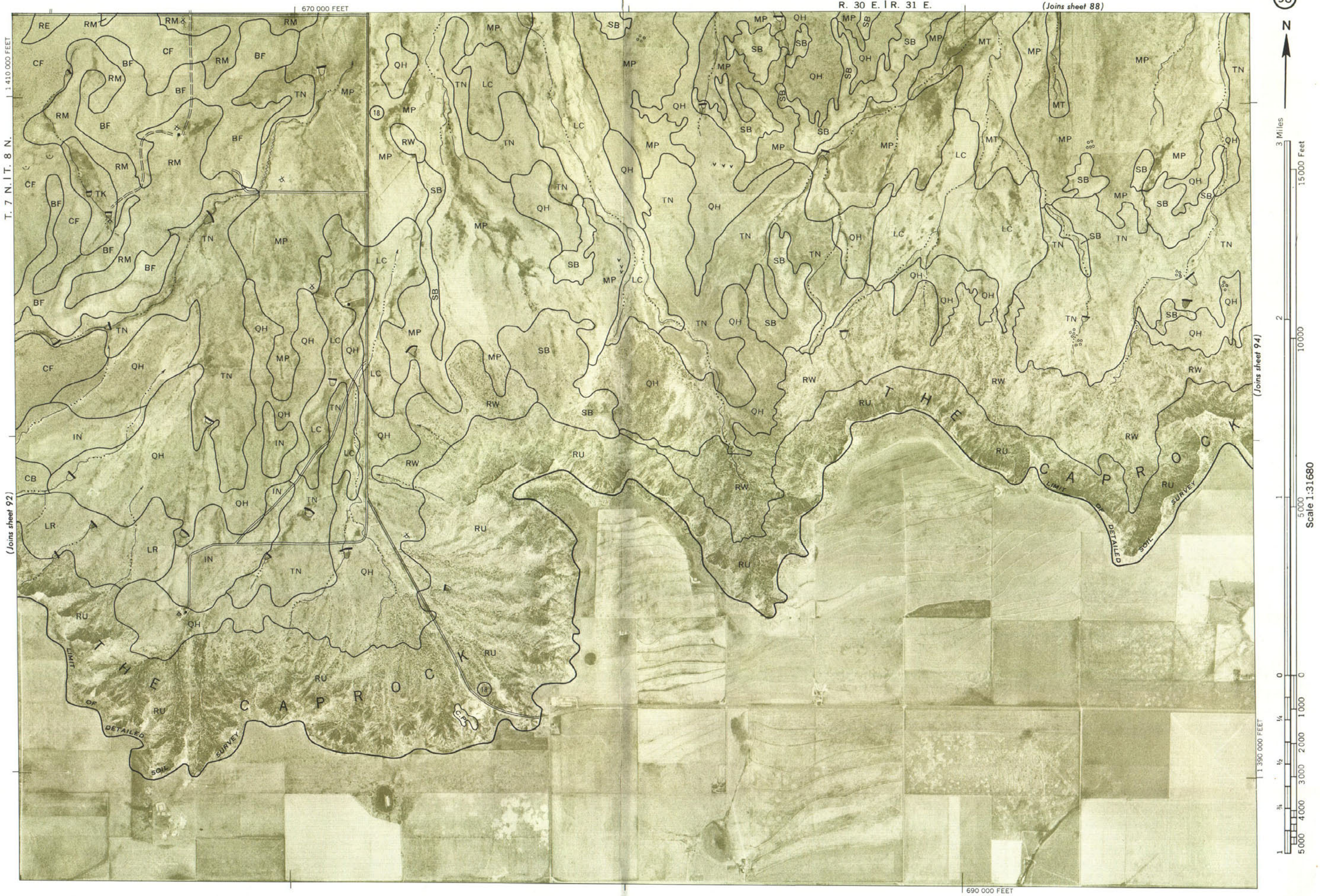
(Joins sheet 93)

THE CAPROCK LIMIT OF DETAILED SOIL SURVEY

Land division corners are approximately positioned on this map.

Photobase from 1969 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Mexico coordinate system, east zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Mexico Agricultural Experiment Station.



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N

Scale 1:31680

3 Miles 2 1 0 15000 Feet 10000 5000

5000 4000 3000 2000 1000 0

1 ¾ ½ ¼ 0

R. 31 E. | R. 32 E. | R. 33 E.

T. 7 N. | T. 8 N.

730 000 FEET

760 000 FEET

700 000 FEET

740 000 FEET

1 410 000 FEET

1 405 000 FEET

1 390 000 FEET

(Joins sheet 89)

(Joins sheet 93)

(Joins sheet 90)

(Joins upper right)

(Joins lower left)

THE CAPROCK

LIMIT OF DETAILED SOIL SURVEY

TN RW IN MP LC QH SB BG LR RU

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